AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OH SCHOOT-ETC F/G 1/2
AN IMPROVED MAINTENANCE MODEL FOR THE SIMULATION OF STRATEGIC A--ETC(U)
HAR 82 W P STANBERRY
ARTI/GST/OS/92M-13
NL AD-A115 745 UNCLASSIFIED 1 or 2 40 4 15°45





AFIT/GST/OS/82M-13

THE OPY PURNISHED TO DDC CONTAINED A SIGNIFICANT NUMBER OF PAGES WHICH DO NOT REPRODUCE LEGIBLY.

AN IMPROVED MAINTENANCE MODEL FOR THE SIMULATION OF STRATEGIC AIRLIFT CAPABILITY

THESIS

AFIT/GST/OS/82M-13 Wayne P. Stanberry Capt USAF



D

Approved for public release; distribution unlimited

82 06 16 072

## **DISCLAIMER NOTICE**

THIS DOCUMENT IS BEST QUALITY PRACTICABLE. THE COPY FURNISHED TO DTIC CONTAINED A SIGNIFICANT NUMBER OF PAGES WHICH DO NOT REPRODUCE LEGIBLY.

# AN IMPROVED MAINTENANCE MODEL FOR THE SIMULATION OF STRATEGIC AIRLIFT CAPABILITY

#### THESIS

Presented to the Faculty of the School of Engineering
of the Air Force Institute of Technology
Air University
in Partial Fulfillment of the
Requirements for the Degree of
Master of Science

Accession For

NTIS GRA&I
DTIC TAB
Unannounced
Justification

By
Distribution/
Availability Codes
Avail and/or
Dist
Special
COPY
INSPECIA
3

Ву

Wayne P. Stanberry

Capt

USAF

Graduate Strategic and Tactical Sciences
March 1982

Approved for public release; distribution unlimited

#### Preface

This thesis is a direct result of the help, encouragement, and support of many people. To Mr. Tom Kowalsky of the Military Airlift Command (XPSR) and his staff, I owe a special debt of gratitude for their continuous support and technical advice. I must sincerely thank Colonel Christopher Shaw for the use of information from his dissertation, as well as Mr. Charles Begin of the Aeronautical Systems Division (ENESA), who was a lifesaver when he offered the use of his data tapes.

Lieutenant Colonel Tom Clark, my advisor, is well deserving of my thanks for his guidance and patience through the months of this effort. Last of all, as it has been for many months, I must think of my family. For Pat and the children, there are no words to express the value of your support and dedication. Your sacrifices have made this thesis possible, and it is as much yours as mine.

Wayne P. Stanberry

### Contents

																									Page
Prefac	ce	•	•		•	•		•		•		•	•	•	•			•	•	•	•		•	•	ii
List	of	Fi	gu:	res	3	•	•			•	•	•	•		•		•	•	•	•	•		•	•	v
List	of	Tal	bl	es		•				•	•	•	•			•		•	•	•			•		vi
Abstra	act		•			•		•	•		•		•	•	•	•		•	•	•	•		•	•	vii
I.	In	tr	odi	uct	:10	on			•			•	•				•	•	•		•	•	•	•	1
																									1
		Ir	np:	lic	:11	t	As	ຮບ	ımp	t:	Lor	າຮ	•	•	•	•	•	•	•	•	•	•	•	•	3 4
		P	rol	ble	em	S	ta	ιtε	me	nt	;	•	•	٠	•	•	•	•	•	•	•	•	•	•	
		Pι	ırı	pos	se	a	nd		)bj	e	tt	LV	es												5 5 6 8
													S												5
													•												6
																								•	Ř
				. • -		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
II.	۷a	110	iai	tic	n		•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	10
		т,	٠÷،	nod	<b>.</b>	<b>.</b> +	10	~																	10
		<u></u>	101	200		ט ם	ムイ	11.	•	•	•	•	•	•	•	•	•	•	•	•	•	•	٠	•	
													•												10
		M	3C1	100	18	U	se	a	٠	•	•	•	•	•	•	٠	•	•	•	•	•	•	٠	•	12
III.	Co	nce	ep1	tua	11:	iz	at	ic	n	•	•	•	•	•	•	•		•	•	•	•	•	•		15
		Τ.	٠+.		1	- +	4 ^	_																	15
													•											•	15
		Ma	111	nte	n	an	ce	_ 5	ys	τe	em	•	•	•	•	•	•	•	•	•	٠	•	•	•	15
													•												16
		Ca	aus	sal	L :	St	ru	ct	ur	·e	•		•	٠	•	•		•		•	•			•	18
		Si	ıbs	3ys	ste	em	s	an	ıd	Sr	ec	:1:	alt	у	C	ode	es								19
				•						•				•											
IV.	An	al	75	İs	aı	nd	M	lea	ເຣບ	re	em€	n	t	•	•	•	•	•	•	•	•	•	•	•	22
		Τr	nti	rod	lu c	at	ia	n	_	_				_	_		_	_	_	_	_	_	_		22
										÷	n <sub>1</sub>		cre					•	•	•	•	•	•	•	
				our										_											22
									•		٠,	•		•	•	•	•	•	•	•	•	•	•	•	23
													de]												32
		Re	gg:	lir	, 7	[1	me	S	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	33
		S	e e	:ia	<b>11</b> t	ъy	C	od	es	F	<b>le</b> ç	lu:	ire	d		•	•	•	•			•			38
		Si	ומו	oly	· I	Зe	au	ir	еπ	er	its	}													43
				nar									•		_		_		_			_	_		43
		-			,		•	•	•	•	•	•	•	٠	•	•	•	٠	•	•	•	•	٠	•	٠,
v.	Co	mpı	ıte	eri	.Ze	at	10	n	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	45
		т.	. 4 -		1		4 -																		li e
													•			•	•	•	•	•	٠	•	•	•	45
		٤٠٠	ını	ζua	$\mathbf{g}$	9		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	45

																		Page
	SLAM Ter	rmino:	logy		•				•	•	•		•			•		46
	Attri	Lbute		•	•	•	•	•	•	•	•	•	•	•	•	•	•	46
	Resou	ırce	. • •	•	•	•	•	•	•	٠	•	•	•	•	•	•	•	47
	Activ	rity		•	•	•	•	•	•	•	•	•	•	•	•	•	•	47
	GOON	Node		•	•	•	•	•	•	•	•	•	•	•	•	٠	•	48
	Assig	zn No	de .	•	•	. •		•	•	•	•	•	•	٠	•	•	•	48
	Await	Node	е.	•	•	•	•	•	•	•	•	•	•	•	•	٠	•	48
	Free	Node		•	•	•	•	•	•	•	•	٠	•	•	•	٠	•	48
	Queue																•	49
	Match	n Node	е	•	•	•	•	•	•	•	٠	٠	•	•	•	•	•	49
		nulat																49
	Event	Node	е.	_•	•	•	•	•	•	•	٠	•	•	٠	•	•	•	49
	Funct	tion 1	<b>JSEF</b>	₹F	•	•	•	•	•	•	•	•	•	•	•	•	•	50
	General																	
	Events .																	
	Supply I																	
	Network.																	55
	Verifica	ation		•	•	•	•	•	•	•	•	•	•	•	•	•	•	62
	Summary			•	•	•	•	•	•	•	٠	•	•	•	•	•	•	62
VI Ext		l Dog	ł ~~															64
AT FX	erimental	L Des.	rRu	•	•	•	•	•	•	•	•	•	•	•	•	٠	•	04
	Introduc	ction												•	•			64
	Proport	ional	ity				•		•		•		•				•	64
	100 Perc	cent 1	Util	iza	ati	.or	ı			•				٠		•	•	67
	Signific	cance	of	Mai	lnt	en	an	ce	N	lar	nni	ne	5					70
	Variance														•			77 -
	Summary																	78
	•																	• -
VII Cor	clusions	and 1	Reco	mme	end	at	10	ns		•	•	•	•	•	•	•	•	79
	Conclusi	long																79
	Recommer			•	•	•		•	•	•	•	•	•	•	•	•	•	80
	Further				•		•	•	•	•	•	•	•	•	•	•	•	80
	rui onei	11636	<b>ar</b> 01.	•	•	•	•	•	•	•	•	•	•	•	•	•	•	00
Bibliogr	aphy .			٠.	•	•	•	•	•	•	•	•	•	•	•	•	•	82
Appendix	A: Bas	lc Ma:	inte	nar	nce	M	lod	el	•	•	•	•	•	•	•	•	•	85
Annendia	. R. Simi	17 a+ 17	an N	inde	٦.													101

## <u>List of Figures</u>

Figure		Page
1	Black Box Model of Maintenance	16
2	Maintenance Logic Structure	17
3	Subsystem Approach	20
4	Inference of Linearity	24
5	Non-Linear Hypothesis	25
6	Actual Data for the C-5	27
7	Calculation of Number of Discrepancies	31
8	Frequencies of Repair Times, WUC 14	36
9	Frequencies of Repair Times, WUC 11	37
10	Entry Node, Events, and Initial Branching	53
11	Expanded View of Initial Branching	57
12	Resource Subnetwork	58
13	Possible Paths from Event 1	60
14	Reassembly of Subsystem	61

## List of Tables

<u>Table</u>		Page
I	Shaw's Parameters for the C-5	29
II	Shaw's Parameters for the C-141	30
III	Subsystems Included in the Model	32
IV	AFSCs Required for Repair	40
V	Conversion of Manning Slots to Effective Teams	42
VI	Percent Utilization of AFSCs	66
VII	Percent Utilization of AFSCs, Maximum Effort	69
VIII	Results of Experimental Runs	75
IX	ANOVA Results	76

#### Abstract

The subject of this thesis is modeling of the maintenance function in the strategic airlift system. The implicit assumptions of the universal maintenance man concept are investigated for applicability. A more detailed model of the maintenance function is developed using SLAM as the primary simulation language. Maintenance manning is modeled at the Air Force Specialty Code level, to allow the possibility of bottlenecks in manning requirements. Maintenance discrepancies are determined for major subsystems of the airlift aircraft, and distributions for repair times are estimated for each subsystem. Substituting the detailed model of maintenance for a model that uses universal maintenance (men, subsequent runs of a simulation of the airlift system show the assumptions of the universal maintenance man concept to be invalid. Additionally, in a simulation using aggregate bases, maintenance manning is not a significant factor.

## AN IMPROVED MAINTENANCE MODEL FOR THE SIMULATION OF STRATEGIC AIRLIFT CAPABILITY

#### I Introduction

#### Background

Strategic airlift is the fastest method to transport men and equipment between theaters of operations. "It is a vital part of the balanced mobility force essential to the attainment of national objectives" (Ref 1:1). The defense of Europe and the North Atlantic Treaty Organization (NATO) allies is one of our primary national objectives, but recent increases in Soviet ground and air forces (Ref 5:100) have made this task more difficult. Our policy of forward defense (Ref 5:98) requires the forces in Europe to hold the Warsaw Pact until reinforcements arrive from the United States. Consequently, the primary objective of the United States Air Force mobility program is to be able, by 1982, to double the American divisions in Europe and increase the number of tactical fighter squadrons by 30 percent, in about ten days (Ref 5:207).

In order to plan defensive tactics, field commanders must know the capabilities of strategic airlift, the primary source of short-term resupply and reinforcement. The transportation feasibility study, as directed by the Joint Strategic Capabilities Plan (Ref 6), usually determines the

1

tactical options of the field commander. To meet the requirements of the planning process, the Military Airlift Command (MAC) has tasked the DCS/Operations Plans "to maintain a simulation capability to evaluate airlift performance and capability in various scenarios" (Ref 11:182). In response to this tasking, the Operations Research Division at MAC, XPSR, has developed an extremely large simulation of the airlift system, M-14.

The M-14 simulation models the airlift system as a network of over 400 bases, through which aircraft, aircrews, and cargo flow. Complex control mechanisms monitor such items as crew duty time, crew rest times and facilities, and cargo load generation. Details of numbers of parking places, taxi times, and servicing capabilities are kept for each base in the system. Aircraft flying times are followed so inspections and unscheduled maintenance tasks can be accomplished by the maintenance force (Ref 9). This amount of detail represents a monumental simulation effort which has resulted in a very large model. There is one area, however, where the amount of detail may not be sufficient to capture the effect on the system.

M-14 uses what is commonly known as universal maintenance men. No distinction is made with regard to specialty skills among the maintenance force. All maintenance personnel are lumped into a pool and assigned from that pool. This is a common approach in modeling the maintenance function,

because it simplifies the complex structure of specialty code manning. Because of the simplification, universal maintenance men are also used in smaller models, such as Holck and Ticknor's thesis effort, modeling the reinforcement of Europe (Ref 8). However, Holck and Ticknor noted that only 65 percent of their maintenance force was ever used at one time, so there were never any delays due to maintenance manning. They hypothesized that this did not represent reality and suggested that further work be done in the analysis of the maintenance area (Ref 8:78).

#### Implicit Assumptions

The use of universal maintenance men implies several assumptions concerning the nature of the airlift system. On face value, it assumes that any maintenance man can fix any discrepancy on an aircraft. With the complexity of modern aircraft, and by the very nature of the specialized training given to the maintenance force, this assumption cannot represent reality. To be acceptable, the use of universal maintenance men must make some other implicit assumptions. First, it assumes that the total number of discrepancies will always be distributed among the aircraft subsystems in exact proportion to the percentage of the maintenance force that is capable of fixing those subsystems. For example, if five percent of the maintenance force consists of the technicians that specialize in radar, for any given period of time, exactly five percent of all maintenance discrepancies will have to

be on radars. Under this assumption, no aircraft can be delayed due to lack of maintenance personnel, until the entire maintenance force is busy.

The second implicit assumption, stemming from the fact that there will be no delays until the entire maintenance force is busy, is that a very high percentage of the maintenance nance force will be used. The only effect that maintenance manning could have, in a simulation of strategic airlift capability, is to cause delays while aircraft wait for maintenance men. Thus, if maintenance manning is modeled, delays must be expected. Since those delays only occur after 100 percent utilization of the maintenance force, that high rate of utilization must be expected.

#### Problem Statement

The implicit assumptions associated with the use of universal maintenance men do not seem to be realistic. Maintenance discrepancies are not likely to occur in exact proportion to the manning levels of the appropriate maintenance specialists. Additionally, it may not be possible to obtain 100 percent utilization of the maintenance force. If these assumptions are not valid, the results from a simulation that employs universal maintenance men, as Holck and Ticknor suggested, may not be representative of the actual maintenance system. Similarly, the effect of maintenance manning on strategic airlift capability may also be misinterpreted.

#### Purpose and Objectives

The purpose of this thesis is to test the implicit assumptions of the universal maintenance man concept and to determine the usefulness of the application of universal maintenance men in simulations of strategic airlift capability. In order to accomplish this purpose, the following objectives were established:

- Develop a realistic model of the maintenance system, with emphasis on a detailed manning structure.
- Determine whether maintenance discrepancies among subsystems occur in proportion to the numbers of specialists capable of repairing them.
- 3. Determine whether 100 percent utilization of the maintenance force is feasible.
- 4. Determine whether maintenance manning has a significant effect on airlift capability.

#### Scope and Limitations

This study deals exclusively with the issue of maintenance manning within a simulation of strategic airlift capability. This model is based on detailed modeling of maintenance manning, rather than the use of universal maintenance men, and is intended only to show the differences in the two approaches. The results of this study or the mathematical methods of modeling this system may not be applicable to

other types of aircraft or other roles. Also, the data, used in this study, was collected during peacetime and may not be representative of the actual wartime figures. However, the general relationships, with which this thesis deals, should apply to both scenarios. Finally, the model developed in this thesis is tailored for inclusion in a simulation of a particular wartime scenario, and it may require expansion or specific tailoring to other scenarios.

#### Methodology

The first objective of this thesis is the development of a credible model of the maintenance system. The model must reflect the processes and interactions that occur between maintenance discrepancies and the maintenance force in the actual system. Stochastic variables, such as the number of discrepancies observed, the probability of requiring off-base supply, the duration of repair times, and the probability of requiring certain specialists, make an analytical approach difficult. Alternately, simulation offers a methodology that handles stochastic variables, allows experimentation with a system that is too complex for direct experimentation, and serves as a tool for the analysis of the behavior of a system (Ref 20:10,11). Therefore, this study employs a simulation model as the primary tool for investigation of the maintenance system.

The methodology for the development of a simulation model is encompassed in the systems science paradigm

(Ref 19:295), and the format of this study parallels that paradigm. The first step in the paradigm is to conceptualize the logic of the interactions of the elements of the system (Ref 19:288). This conceptualization requires an understanding of the system and how it operates, both internally and with its environment. The second step, analysis and measurement, requires the quantification of the interactive processes and the means of measurement (Ref 19:299-301). This portion includes the analysis of input data and the development of a mathematical model of the system. Finally, the third step involves the conversion of the mathematical model into a computer model (Ref 19:302). Again, the computerization process must retain the logic of the flow through the system, as conceptualized in the first step.

This three-step process for development of the simulation model is also iterative, in that analysis of the computer model often leads to reconceptualization of the system, and the process starts over (Ref 19:302). The three steps, presented in Chapters III, IV, and V, represent the final iteration of the paradigm in this study of the maintenance system. Together, they form the process by which a representative computer model of the maintenance system was developed. However, a model is of no use unless its validity can be established. Since validation is part of each step in development of the model, the approach to validation is discussed in Chapter II, prior to the development of the model. With

this representative model, the analysis required to meet the other objectives of this thesis was accomplished.

Determining the validity of the assumptions of the universal maintenance man concept requires analysis of the internal behavior of the maintenance system. Likewise, determining the significance of maintenance manning requires an analysis of the maintenance system in operation, inside the larger airlift system. The role of experimental design is to plan both the form of the computer model, for partial analysis of the behavior of the system, and the final strategic and tactical plans for execution of an experiment (Ref 20: 149). The experimental design for this thesis accomplishes both of these. The model was designed to produce useable statistics on the utilization of the maintenance force, and the experiments were designed specifically to test the levels of manning utilization and the significance of maintenance manning on the airlift system. Finally, the Statistical Package for the Social Sciences (SPSS) (Ref 14) was used to do the statistical analysis of the results of those experiments.

#### Overview

The remainder of this thesis details the process by which the study was conducted, presents the findings, and lists the conclusions and recommendations. Chapter II explains the validation process and the particular methods of validation used in this study. As previously mentioned,

Chapters III, IV, and V represent the process of developing the simulation model. Chapter III presents the maintenance system and conceptualizes the processes within the system. Chapter IV details the methods used to develop a mathematical model of the system and determine its inputs. Finally, Chapter V shows the computerization of the mathematical model and the verification of the computer model. Chapter VI explains the experimental design used to analyze the maintenance system and discusses the results of those experiments. Chapter VII lists the conclusions and recommendations for both application of these results and further research.

#### II <u>Validation</u>

#### Introduction

If a simulation model is to be used as a tool for the investigation of a system, as is the case in this thesis, the validity of that tool must be established. Although the definition of validation is somewhat elusive, most authors include three concepts in their definitions. First, the purpose of the model must be accomplished. Second, the fact that any inferences drawn from the model are applicable to the actual system must be established. Last, but most important, validation is a process of building confidence in the model and its outputs. Naturally, since this is a continuing process, we can never attain absolute validity (Ref 17). Because validation encompasses the entire process of modeling, this chapter on validation is presented to explain the validation methods in this thesis, prior to the chapters on model development.

#### Current Philosophy

The process orientation of validation is supported by the general acceptance of Naylor and Finger's multi-stage approach to validation (Ref 13:B-92). In order to build confidence in the model, throughout the simulation process, the idea of looking back, after the simulation is finished, to try to validate what was done, must be discarded. Averill Law suggests that model development and validation must be

done hand in hand, throughout the course of the simulation study (Ref 10:338). Additionally, Sargent (Ref 17) and Van Horn (Ref 25) agree that documentation, throughout the study, is the key to confidence building.

The multi-stage approach encompasses all three of the underlying philosophies of validation. The rationalist view, based on synthetic a priori or unquestionable truths, suggests that the validity of a model is based on the unquestionable system of logic inherent in the model. The empiricist suggests that all assumptions and hypotheses must be empirically verified, and positive economics maintains that the output, or predictive ability of the model, is all important (Ref 13: B-93 to B-95 and 20:212-214). Combining all of these, the most rigorous method of validation includes demonstration of clear logic underlying the model and its assumptions, mathematical verification of all inputs and processes within the model, and comparison of outputs with the actual system. Thus, validation begins with the conceptual stage of development and continues through the entire process of model building.

Complete validation, as described above, should be a goal of any study, however, not all models can be completely validated. Note that complete validation does not infer absolute validity, but only the completion of all the phases of the validation process. If the system being modeled is only a proposed system, or the scenario being modeled is

expected in the future, no actual system outputs are available for comparison to model outputs. Positive economics implies that this situation cannot be validated, but a multistage approach still leaves two stages for partial validation. If the logic of the model and mathematical processes are shown to be valid, confidence in the model is increased and a higher level of validity is achieved.

#### Methods Used

The model, developed in this thesis, simulates a large and complex system that is not amenable to direct experimentation. Additionally, only a portion of the actual system is directly incorporated into the model. Also, to experiment with the model, it is included in a simulation of a future scenario. For these reasons, comparison of model outputs to actual system outputs is not feasible. Therefore, validation of this model relies heavily on the acceptance of its logic and the verification of its inputs. Additionally, the primary purpose of this model is to investigate the nature of the processes that occur within the maintenance system, and not to observe specific output data. Since validation applies only to the intended purpose of the model, the emphasis of validation is placed on the proper representation of those inner processes in this model.

Since the validity of this model depends on the acceptability of its logic and inputs, every effort has been made to explain each step of model development in detail.

The logic employed has been kept as straightforward as possible, while allowing enough detail and complexity to capture the true nature of the system. The initial test of the validity of this logic is its acceptance by Lieutenant Colonel Thomas C. Clark, the advisor for this thesis. His extensive experience, in both simulation modeling and the aircraft maintenance field, provides the basis for an expert judgement of this modeling effort. The final judgement, of course, is left to the individual reader of this thesis.

The inputs and mathematical processes, developed in Chapter IV, have been individually validated as much as possible. Where applicable, previous validation of individual inputs is cited. Statistical methods and justification for these methods are explained, and references are given for each method. No credit is taken for an exhaustive study of each input; however, the limitations and additional considerations are discussed for each input. Also, the possible effect of these limitations, on the results of this study, are considered.

Besides the steps described above, additional confidence can be gained by ensuring that the logic, developed in Chapters III and IV, is properly translated into the computer program, and the program runs as expected (Ref 7: 12-19). This process is commonly referred to as the verification of the model, and the verification procedures are discussed at the end of Chapter V. Taken as a whole, the

validation attempts should support the validity of this model for its intended purpose.

#### III <u>Conceptualization</u>

#### Introduction

In order to accurately model any system, the nature of the system must be understood, and the interactions of that system with its environment must be analyzed. This conceptualization process begins at a highly abstract level and incrementally decreases in abstraction as details are added to the conceptual model (Ref 19:290). The approach taken here follows the same pattern. The maintenance system is analyzed and a conceptual model is developed in an increasingly complex form.

#### Maintenance System

The maintenance system is actually a subset of the complete airlift system, and it acts as an input-output system. In the most basic form, maintenance can be considered a black box that gets an input from the airlift system. This input is an aircraft that has completed a sortie and, in the process, may have generated some maintenance discrepancies. The black box holds the aircraft for a given period of time and then returns the aircraft to the airlift system when the discrepancies are fixed (see Figure 1). If the time delay, while in maintenance, could be determined without any more detail than this, modeling this system would be a simple matter of determining the longest repair time for any discrepancy. However, there are several limiting factors not

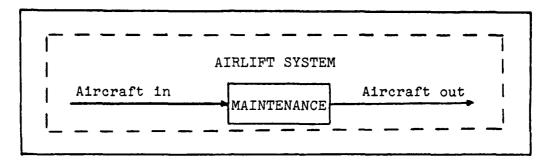


Fig 1. Black Box Model of Maintenance

yet accounted for. Of particular interest, in this study, is the possibility that the aircraft may incur additional waiting time due to a lack of qualified maintenance personnel.

#### Additional Factors

If the availability of maintenance personnel is considered, spare parts must also be included. The availability of spare parts determines whether personnel remain at work, or are released until parts can be acquired. A new logic flow (see Figure 2) is generated for this case. When an aircraft enters maintenance, a determination of the number of discrepancies is made. If none, the aircraft is mission-ready and departs maintenance. If maintenance is required, personnel are assigned to begin work on the discrepancies. If spare parts are required and are immediately available, or, if no parts are required, work continues until the aircraft is fixed. If parts are required, but are not available, the parts are ordered and the personnel freed until the parts

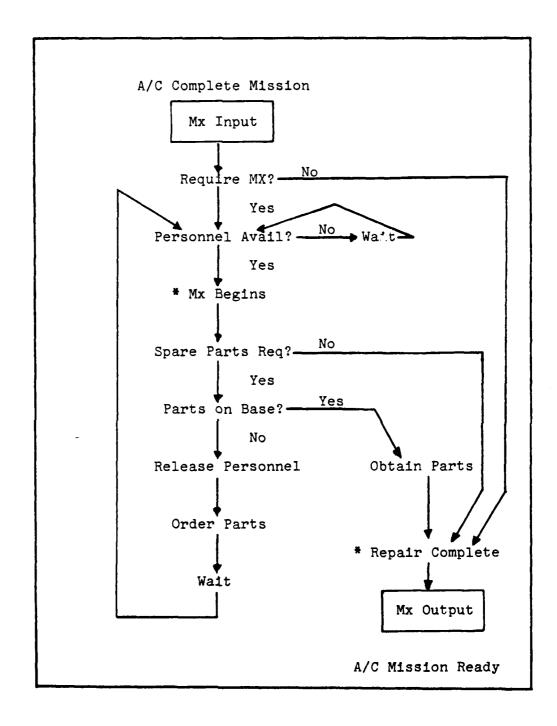


Fig 2. Maintenance Logic Structure

water the state of 
arrive. At that time, personnel are again allocated to the aircraft to finish the job.

This is the level of conceptualization that the universal maintenance men are used. One resource, consisting of all maintenance men, is used, with no differentiation of specialty skills. Additionally, at this level, many other factors are assumed to be insignificant. The availability of maintenance facilities and weather are two examples that have some impact on the amount of time spent in maintenance. However, in keeping with the idea that a model should be designed around the questions to be answered rather than imitate the real system exactly (Ref 20:27), these factors can be discounted. Without facilities and with inclement weather, the jobs could still be accomplished, perhaps requiring more time than normal. Since the emphasis of this study is not to determine exact maintenance times, but to investigate the effects of manning on that time, the inclusion of these factors would complicate the model unnecessarily.

#### Causal Structure

At this point, the conceptual model is still relatively simple. As the number of aircraft, or the utilization rate of those aircraft, increases, more maintenance discrepancies are encountered. These discrepancies require more personnel and spare parts, and either of these can become a limiting factor. If the spare parts are depleted, aircraft must wait until parts are made available from off-base sources. If

18

in the second second

the number of personnel available is exceeded, aircraft must wait for other work to be completed and personnel freed. The end result of either of these circumstances is extended time in maintenance and a decrease in aircraft utilization. Thus, maintenance acts as a self-regulating feedback loop (Ref 20: 63). The effect of this loop, on the airlift system, is to control the number of aircraft flying in the system.

#### Subsystems and Specialty Codes

In order to analyze the distribution of maintenance requirements among the specialists, one more level of complexity must be added to the conceptual model. In the actual maintenance system, the maintenance force is divided into groups of specialists that receive technical training in the maintenance of particular types of equipment. These groups are designated by Air Force Specialty Codes(AFSCs) (Ref 2) and are essentially non-interchangeable. Thus, there are actually a group of AFSCs, each of which could be a limiting factor. Additionally, each subsystem on an aircraft can require a different AFSC or combination of AFSCs for repair. For example, a discrepancy in the landing gear subsystem can require specialists in electrical systems, hydraulics, pneumatics, or the physical hardware of the gear itself.

At this level of complexity, an incoming aircraft can be depicted as a simultaneous input of several subsystems to the maintenance function (see Figure 3). Each of these subsystems goes through a separate process, using the logic

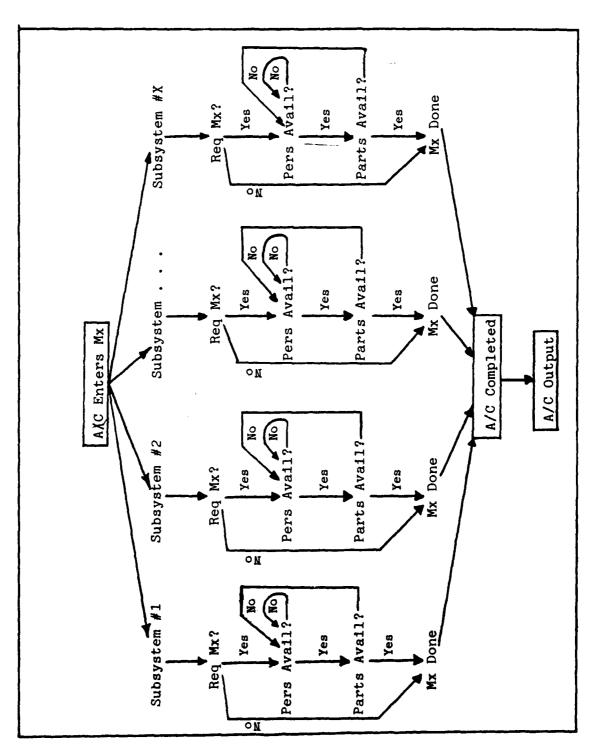


Fig 3. Subsystem Approach

shown in Figure 2, where they compete for the personnel from the appropriate AFSCs. After all of the subsystems have completed their maintenance, the aircraft is aggregated as a whole entity and output from the maintenance function.

Finally, at this level of complexity, the proportion of discrepancies requiring each maintenance specialist can be observed, so the assumptions of the universal maintenance man concept can be tested. Therefore, no further conceptualization is necessary, and the logic depicted in Figure 3 will be the logic that is passed to the next phase for analysis and measurement.

#### IV Analysis and Measurement

#### Introduction

Once the logic of the conceptual model has been developed, that logic must be converted to a mathematical model which can be computerized. In order to develop the mathematical model, each element and process in the conceptual model must be quantified. This chapter deals with the analysis of those elements and processes and the methods used to quantify them. From Figure 3 in Chapter III, the logic of the conceptual model requires a determination of:

- 1. Which subsystem must be included in the model?
- 2. How many discrepancies will be encountered by each subsystem?
- 3. Which AFSCs are required to repair those discrepancies?
- 4. How long does that repair take?
- 5. Are spare parts required for each discrepancy?
- 6. What delay, if any, will be incurred while waiting for spare parts?

The answers to some of these questions are dependent on the scenario for which the model will be used. For instance, the difference between normal operations and a wartime scenario might make a large difference in the number of subsystems required. In wartime, only the critical subsystems that might prevent safe flight would have to be repaired. Because of this scenario dependence, the model will be

22

developed for a particular scenario. Holck and Ticknor's simulation of the reinforcement of Europe (Ref 8) was chosen as an example of the use of the maintenance model developed in this thesis. The reasons for this choice will be explained in Chapter VI, but any simulation of airlift capability could use this approach to modeling the maintenance area.

Holck and Ticknor simulated a wartime scenario, using aggregate bases. Thus, the model, as developed in this thesis, will reflect that scenario. Only certain subsystems will be considered, and the entire maintenance force will be modeled as if it was positioned at one aggregate base where maintenance takes place. As will be seen in Chapter VII, this limited application did not prevent the model from showing the processes of interest in this thesis. The remainder of this section will detail the methods used to quantify each of the questions previously listed.

### Determination of Discrepancies Encountered

As previously mentioned, most simulations use universal maintenance men, so there has been no reason to differentiate between discrepancies encountered in different subsystems. Thus, no distributions of maintenance discrepancies were available, at the subsystem level. However, Colonel Christopher Shaw, Chief of the Mobility Branch, Studies and Analysis, Headquarters USAF, has derived a set of equations to give the expected number of failures for each subsystem (Ref 21). His research will be discussed, followed by the

23

method used to convert his expected failures to the actual number of failures encountered.

Colonel Shaw's research was done, primarily, to determine the number of spare parts required to support the airlift fleet. His data deals exclusively with maintenance actions that require removal and replacement of a part, or removal, repair, and replacement. These actions represent the major part of the time consuming maintenance jobs, and they include all of the jobs that require spare parts. Thus, his data appears to be applicable to the purpose of this model.

Most simulations use a constant number of maintenance actions per flying hour, but this infers that there is a linear relationship between length of time flown and the number of maintenance discrepancies (see Figure 4). In other words, given a constant failure rate per flying hour, three

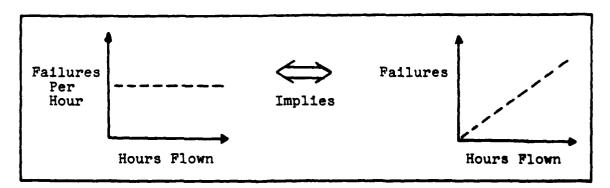


Fig 4. Inference of Linearity

times as many discrepancies can be expected on a three hour flight as a one hour flight. This does not appear to fit reality, since most crewmembers will hypothesize that the majority of failures occur during the takeoff or landing phases of flight, and relatively few failures occur during cruise.

colonel Shaw hypothesizes that most failures are cycle related because of thermal stress. As equipment is turned on and off, the associated heating and cooling is responsible for failures. Also, cycling of systems, such as the landing gear and flaps, puts stress on the individual parts and results in their failure. Conversely, during cruise, termperatures are relatively constant and systems like the gear and flaps are not being cycled. As a result, there is a much lower failure rate during the cruise phase than in the high stress phases of takeoff and landing (Ref 21). Thus, a long sortie that spends many hours at cruise would experience less failures per hour than a short sortie (see Figure 5).

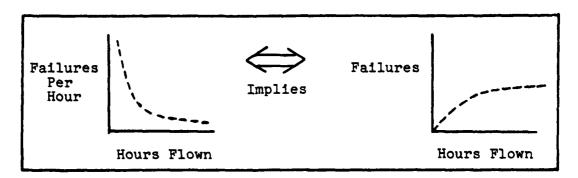


Fig 5. Non-Linear Hypothesis

To validate his hypothesis, Colonel Shaw was the study director for Saber Sustainer, a study of the relationship between failure rates and length of sorties. The study concentrated on major subsystems of many different aircraft, including the C-5. The results for the C-5 were representative of all the aircraft and will be presented as an example of a strategic airlift aircraft. A baseline of 12.5 hours per day utilization rate was established and sortie lengths of 5 and 10 hours were investigated. The results were very much as Shaw predicted:

5 hour sortie = 23.3 failures per day 10 hour sortie = 14.3 failures per day

OR

2 times sortie length = 39% fewer failures per day

In addition, approximately 75% of all failures occur during takeoff and landing (Ref 22). Not surprisingly, this led to a graph of failures per flight hour against sortic length (see Figure 6) that is very similar to the hypothesized non-linear model.

The end result of Shaw's study was to derive a simple equation for the expected number of failures which reflected the non-linear nature of the failure rate. Since all sorties experience the high failure rates of takeoff and landing, those portions of the flight could be approximated by a constant expected number of failures. Then, the remaining

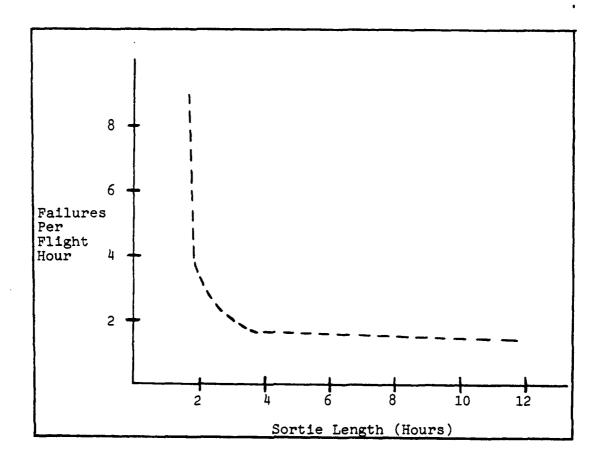


Fig 6. Actual Data for the C-5

portion of the flight could be approximated by the relatively constant rate of failure at cruise. Using regression analysis, Shaw derived the expected number of failures, as a function of sortie length, in the familiar form (Ref 21):

Y = A + BX

where,

Y = Expected number of failures

A = Constant due to start and stop

- B = Adjusted failure rate
- X = Sortie length in hours

The accuracy of these equations was tested by direct data gathering in the field. Selected aircraft were followed and specific maintenance discrepancies were tabulated. The results showed an excellent correlation between failures predicted by the equations and those actually encountered (Ref 22). Thus, Shaw's non-linear hypothesis was supported by the Saber Sustainer Study, and his resulting equations appear to be consistent.

For the purpose of this thesis, Shaw's study results in a table of parameters, by aircraft type, which can be inserted into the equation previously given. Table I lists the parameters for the C-5, and Table II lists the parameters for the C-141. In both tables, parameters are listed for each major subsystem, and the two-digit Work Unit Codes (WUC) (Ref 23 and 24) that identify those subsystems are shown. With these parameters and the sortic length, the expected number of failures in any subsystem can be determined. However, this expected number of failures is an average number that could be expected over a series of flights of the same sortic length, and is usually a non-integer number.

In this model, the actual number of discrepancies encountered, for any given subsystem, must be an integer number. In the actual system, it is impossible to see one and a half failures in a subsystem. For this reason, an

TABLE I
Shaw's Parameters for the C-5

WUC	Subsystem	A	<u>B</u>
11	Airframe	•373	.012
12	Cockpit & Fuselage	.194	.028
13	Landing Gear	.614	.035
14	Flight Controls	.074	.018
23	TF-39 Turbofan Engine	.253	.096
24	Auxiliary Power Plant	.064	.018
41	Air Conditioning & Press.	.080	.027
42	Electrical Power Supply	.118	.030
44	Lighting System	.771	.375
45	Hydraulics and Pneumatics	.151	.048
46	Fuel System	.111	.012
47	Oxygen System	.041	.005
49	Misc. Utilities	.061	.020
51	Instruments	.122	.049
52	Autopilot	.067	.035
55	Malfunction Analysis Equip.	.262	.085
61	HF Communications	.013	.021
63	UHF Communications	.024	.004
64	Interphone	.016	.010
65	IFF	.003	.004
71	Radio Navigation	.060	.016
72	Radar Navigation	.138	.063

TABLE II
Shaw's Parameters for the C-141

WUC	Subsystem	A	<u>B</u>
11	Airframe	.0336	.0604
12	Fuselage Compartments	.0443	.0451
13	Landing Gear	.0317	.0508
14	Flight Controls	.0129	.0278
23	TF-33 Engine	.0524	.0772
24	Auxiliary Power Plant	.0048	.0051
41	Air Conditioning-Press.	.0106	.0190
42	Electrical Power Supply	.0065	.0070
44	Lighting Systems	.0288	.0334
45	Hydraulic Power Supply	.0097	.0292
46	Fuel System	.0120	.0080
49	Misc. Utilities	.0092	.0120
51	Instruments	.0218	.0181
52	Automatic Flight Controls	.0276	.0253
62	VHF Communications	.0050	.0051
63	UHF Communications	.0180	.0033
64	Interphone	.0007	.0152
65	IFF	.0021	.0049
71	Radio Navigation Systems	.0486	.0135
72	Radar Navigation Systems	.0709	.0266
73	Station Keeping (INS)	.0138	.0120

extension to Shaw's work had to be made. Since time to failure of individual parts is often exponentially distributed (Ref 12:8), the numbers of failures would be expected to be Poisson distributed (Ref 16:31). Therefore, the actual number of discrepancies encountered should be Poisson distributed, with the mean of the distribution given by Shaw's equation. This assumption does not invalidate the regression procedure, since a normal distribution of the errors is not required to estimate the regression line (Ref 26:282-285). Thus, the number of discrepancies for any given subsystem is obtained as a random variate from a Poisson distribution. The mean of that distribution is equal to the expected number of discrepancies from Shaw's equation. An example of this process is shown in Figure 7.

Assume: X = Sortie Length = 10 hours

Subsystem = TF-39 Engine

Aircraft = C-5

From Table I:

A = .253B = .096

Calculation of Expected Number of Discrepancies (Y):

Y = A + BX

Y = .253 + .096(10)

Y = 1.213

Actual Number of Discrepancies =

Random Variate Drawn From a Poisson Distribution With a Mean of 1.213.

Actual Number = 2

Fig 7. Calculation of Number of Discrepancies

# Subsystems in the Model

Since this model is designed for strategic airlift, only the C-5 and C-141 aircraft are considered. Also, the use of this model would primarily be in a simulation to determine airlift capability under some wartime scenario.

Therefore, only those subsystems likely to include items on the wartime Minimum Essential Subsystems List (MESL) are considered. Of those, only the subsystems with relatively high probabilities of failure, as determined from Shaw's equations, were included in the model. The subsystems used in the model are shown in Table III, with the two-digit work unit code that identifies each system (Ref 23 and 24).

TABLE III
Subsystems Included in the Model

	Wo	rk Unit Code	Subsystem
1.	11	(both A/C)	Airframe
2.	13	(both A/C)	Landing Gear
3.	14	(both A/C)	Flight Controls
4.	23	(both A/C)	Engine
5.	42	(both A/C)	Electrical System
6.	45	(both A/C)	Hydraulics
7.	46	(both A/C)	Fuel System
8.	51	(both A/C)	Instruments
9.	72	(both A/C)	Radar
10.	55	(C-5)	Malfunction Analysis
11.	73	(C-141)	Inertial Navigation

#### Repair Times

Most simulations use a single distribution from which they draw all times to repair. Because there may be significant differences between subsystems, an attempt was made to estimate the distributions for each subsystem in the model. A data base, separable by distinct subsystem, was required to estimate these distributions. Initially the latest sixmonth maintenance data tapes from Charleston (C-141s) and Dover (C-5s) were requested from MAC Headquarters. These tapes report the maintenance actions as individual observations, and represent the raw, non-aggregated data required to accurately determine the distributions. Unfortunately, due to tape drive problems, those tapes were not available.

As a secondary source, Mr. Charles Begin, ASD/ENESA, was contacted, and he provided data tapes (Ref 4) that had been acquired from MAC earlier. One tape covered the period, January-June 1980, for Dover AFB. It represented 2,214 sorties and 11,652 flying hours for the C-5. The other tape covered the period, July 1979-June 1980, for Charleston AFB. It represented 17,953 sorties and 62,773 flying hours for the C-141. These tapes are base-level, raw maintenance data, as expected. However, the sheer size of the maintenance data file, 1200 record blocks for one tape, represented a major obstacle to useful manipulation. Additionally, the maintenance reporting procedures make the data difficult to use. Discontinuities in time reporting, unfinished transactions,

and multiple inputs for a single discrepancy are only a few of the inherent problems.

In order to get useful information from the tapes, a different version of the basic data tapes was used, the A-1 tape. The A-1 is a condensed version of the raw data tapes that has been organized by sorting the raw data tapes with the Consolidated Data Extraction Program (CDEP). The CDEP converts the codes on the data tapes to standard AFSCs and sorts the records by aircraft type. On a second pass through the data, it consolidates information to eliminate multiple records on the same job control number. This combines offequipment maintenance with on-equipment removals, compacts times for overlapping or discontinuous work when several AFSCs are working the same job, and adjusts the crew size for overlapping times worked by different crews. On the third pass, the data is arranged by work unit code numbers, formatted in a job-by-job analysis, and any entries that required the same combination of AFSCs to work on a subsystem are aggregated to provide an average time and crew size for that type of entry (Ref 3).

The A-1 tape is formatted for easy access to information. Its principle benefit is that all jobs are reported as continuous actions, with all unnecessary delays and discontinuities eliminated. Also, multiple entries are combined and listed as multiple AFSCs working on the same job. Unfortunately, the aggregation of all jobs using the same AFSCs

tends to obscure the nature of the underlying distribution of repair times. This aggregation lumps groups of data points at their mean value and reports "X" number of occurrences of the same maintenance time. The result of this grouping is an inability to test the data against specific distributions. Statistical tests, such as the Chi-Square test, rely on relative frequencies of occurrences to test distributions (Ref 15:70), but the grouping of data points in the A-1 tape destroys those relative frequencies. Therefore, some other method of estimating the distributions had to be used.

In Techniques for Efficient Monte Carlo Simulation, the Defense Technical Information Center (DTIC) document on the selection of probability distributions (Ref 12:7), equal emphasis is placed on quantitative and qualitative information. The qualitative aspect includes the extent of a priori knowledge about the process under consideration. In that same document, the authors state that maintainability theory provides a strong likelihood that repair times would be lognormal or gamma distributed (Ref 12:8). To support this hypothesis, a graphical analysis of the characteristic shapes of the distribution of maintenance times was performed. observations for each subsystem were input to the Statistical Package for the Social Sciences (SPSS) Subprogram Frequencies (Ref 14:194), to get a plot of the frequency distribution in a histogram. Two representative plots of these frequencies are shown in Figures 8 and 9. Work Unit Code

Fig 8. Frequencies of Repair Times, WUC 14

Fig 9. Frequencies of Repair Times, WUC 11

(WUC) 23, in Figure 8, represents the time to repair engine malfunctions for C-5s, and it displays the typical shape that could be either gamma or lognormal. WUC 11, in Figure 9, represents C-5 airframe repair times, and it appears to approach an exponential curve, a special case of the gamma. Since the gamma distribution is more flexible, using shape parameters, it was selected as the representative distribution.

The mean and variance of the sample data were used as estimates for the mean and variance of the underlying distributions, and the following equations were used to estimate the gamma parameters (Ref 26:132):

$$\mu = \alpha \beta$$
 and  $\sigma^2 = \alpha \beta^2$ 

Thus, each subsystem has its own distribution of repair times. All are gamma distributed, but the shape parameters are different for each subsystem. These are only estimates of the repair time distributions, based on estimates from the reported data and established knowledge of maintainability theory. However, they should be more representative of actual repair times than drawing from a single tabular distribution of historical repair times.

## Specialty Codes Required

The A-1 data tapes (Ref 4) gave an excellent description of the AFSCs required for repair of each subsystem. A program was written to extract, by aircraft and subsystem, all of the AFSCs that had worked on each particular subsystem.

Also, the total number of times that each AFSC was required, divided by the total of all jobs on that subsystem, yielded the percentage of jobs that required each AFSC. The listing of the subsystems and required AFSCs, plus the percentage of jobs that required those AFSCs, is fairly extensive.

By disregarding any AFSC that did not account for at least 4.9 percent of the total jobs, only thirteen AFSCs were represented. The reason for dropping the lower percentage AFSCs is obvious. If they are only used to that small a degree, there is almost no chance that they could be a limiting factor in the manning scheme. Those AFSCs will not be modeled, but the jobs will be accomplished, as if there were an infinite number of those maintenance men available. Likewise, the 431P2 and 431X2 AFSCs were dropped from the model because their manning levels were so high, they could allocate a maintenance team to every aircraft in the MAC fleet. Also, these AFSCs are the flight line crew chiefs and the isochronal dock general aircraft maintenance men. Their specialties do not represent the specific type of maintenance of interest in this study, since they do very general maintenance tasks.

With the exclusion of these AFSCs only eleven AFSCs were of interest in the model. The percentage of total jobs, on each subsystem, requiring each AFSC is depicted in Table IV. These percentages do not add to 100 percent for each subsystem because of the jobs that will be done by AFSCs not modeled. Once the type of maintenance specialties required

TABLE IV

AFSCs Required for Repair

A/C 431R2 431W2 423X0 423X1 423X3 423X4 426X2 325X0 325X1 328X1 328X4					2. 8.2	88 88 178 178	11 % 6 %	88 88 88 	64 84 84 84 84 84 84 84 84 84 84 84 84 84	8 8 8 80 00 00 00 00 00 00 00 00 00 00 00 00 00	24 ps	86 86 86 86 86 86 86 86 86 86 86 86 86 8	56 56 56 56 56 56 56 56 56 56 56 56 56 5	56 56 56 56 56 56 56 56 56 56 56 56 56 5	56 56 56 56 56 56 56 56 56 56 56 56 56 5	56 56 56 56 56 56 56 56 56 56 56 56 56 5	6.8% 15.6% 38.9% 33.0% 5.1% 6.5% 5.2% 27.8% 99.2%	66 86 86 86 86 86 86 86 86 86 86 86 86 8	4% 6% 9% 0% 5% 8% 11.8% 99.2% 58.8% 40.0%	
X0 325X					7.4%	7.4%		7 7	1 1 1 1 1 1 1	1 10 0	1	1 N N			2 3 1 1 2 2	1 6 6 6 6 6	38.9 33.0 33.0 33.0 5.2 39.2 27.8 99.2 52.8	38.9 33.0 33.0 33.0 5.2 5.2 5.2 5.2 5.2 5.2	38.9 33.0 33.0 33.0 39.2 5.2 5.2 5.2 5.2	38.6 33.0 33.0 33.0 5.2 5.2 99.2 27.8
426X2 325		-	- T			6.	6.	6.	<del> </del>	<del>┣</del> ┈┈┝┈┈┤┈	<del>     </del>	<del>├──</del>	<del> </del>	<del>├───</del>	<del>         </del>	<del>├───</del> <del>├</del> ── <del>├</del> ── <del></del>	المائمية والتاريخ والمستدار والمستدي والأسارار بمستدي والمستدي		التستسين استسب سنتفض سيسي بينسيس بالنسفار بنسين	الكال المستسبرة السانحية ومتفاضل ومستمين ومنسون والمعامل والمناوات
423X4 4	34.0%	23.2%		30.2%	30.2%	30.2% 20.1% 22.8%	30.2% 20.1% 22.8% 49.3%	<del> </del>	<del>  </del>	<del>   =-= </del>		<del>   ==  </del>	<del>                                     </del>	30.2% 20.1% 22.8% 49.3% 49.3% 72.0%	30.2% 20.1% 22.8% 49.3% 4 4 4 4 72.0%	30.2% 20.1% 22.8% 49.3% 49.3% 72.0%	30.2% 20.1% 22.8% 49.3% 4 4 4 72.0%	30.2% 20.1% 22.8% 49.3% 40.3% 72.0%	30.2% 20.1% 22.8% 49.3% 49.3% 72.0%	30.2% 20.1% 22.8% 49.3% 40.3% 72.0%
(1 423X3				_										54.00 %	<del>╿╸</del> ╼╼╌┋╌┄┈┪┈┈┈┪┈ <sub>┪</sub>	<del>╿</del> ┈┈┈┈┈┈┈┈ <del>┈</del> ╟┈┈┈┈ <del>╏</del> ┈┈┈┈┼┈┈	<del> </del>	<b>∤−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−</b>	<del> </del>	<del> </del>
(0 423)		80		32	N 80	pe pe pe	be be be be	be be be	M M M M	M M M M M	be be be be be	be be be be	11 to 16 to		المراب المراق والمراق	والمراوين والمسرول والمراوي والمراوي والمراوي والمراوي والمراوي والمراوي والمراوي والمراوي والمراوي	المعارض والمسرول والمساوح المستعدد والمستعدد والمستعدد والمستعدد والمستعدد والمستعدد والمستعدد والمستعدد والمستعدد	والمراب المسترين والمسترين والمسترين والمسترين والمسترين والمسترين والمسترين والمسترين والمسترين والمسترين	وبين بين والمستقل والمستقل والمستوان والمستوان والمستور والمتحدث والمتحدد والمتحدد والمستور والمستور	والمراز
2 423X		5.1%		14.5%			7 7 7										······································	······································	······································	······································
431W2				47.3%	47.3% 47.2%															
431R2	141 30.3%	C-5 26.4%			4.78	[2]	10 7	100 001					1 10 71 1 1	1 10 71 1 1						
ŀ		C-5		╀─	-	<del>}</del>	141 C-5 141 C-5	141 141 141 C-5 141	141 C-5 141 C-5 141 C-5	141 C-5 141 C-5 141 141	141 C-5 141 C-5 141 C-5 C-5	141 C-5 141 C-5 141 C-5 141	141 C-5 141 C-5 141 C-5 141 C-5	141 141 141 141 141 141 141	141 141 141 141 141 141 141 C-5 141 C-5	141 141 141 141 141 141 141 141	141 141 141 141 141 141 141 141 141	141 141 141 141 141 141 141 141 141 141	141 141 141 141 141 141 141 141 141 141	141 141 141 141 141 141 141 141 141 141
MUC	11			13	13	13	13	13	13	13 14 23 42	13 14 42	13 23 42 45	13 23 42 45	13 23 42 45 46	13 23 42 45 46	13 23 42 42 45 46 51	13 14 14 15 16 16 16	13 23 42 45 45 72	13 14 42 45 45 72	13 42 45 45 45 72 73

was determined, the next step was to determine the number of effective maintenance teams in each of those specialties.

Senior Master Sergeant George Scarborough (Ref 18) obtained all of the manning data used here. He has extensive experience working with the Logistics Composite Model (LCOM), and he has recently been working with the M-14 simulation. All of the figures, quoted here, are used as standard inputs to LCOM or are standard Air Force planning factors. As a baseline figure, the current manning authorizations for each AFSC were used. Throughout maintenance, only 75 to 80 percent of the authorized slots are currently manned. Optimistically, this study assumes that 80 percent of the authorizations are manned.

In order to use the manning in the model, the manning figures had to be converted to effective maintenance teams. The Air Force Maintenance and Supply Management Engineering Team estimates that 82 percent of available man-hours are effective, so this model used 82 percent of the available manning as productive manning. Then, the productive manning levels were divided into two shifts, and further divided into 2.5 men teams. The team size is an average of all the teams represented on the A-1 data tape. The final figure represents the number of effective teams that will be available at any given time. Table V shows the numbers and process used in deriving these teams.

AFSC	Auth. Slots	Manned Slots	Prod. Slots	Men/ Shift	Teams
431R2	564	451	370	185	74
431W2	140	112	92	46	18
423X0	329	263	216	108	43
423X4	438	350	287	143	57
426X2	1471	1177	965	482	193
423X1	347	278	228	114	46
423X3	215	172	141	70	28
325X1	341	273	224	112	45
325X0	283	226	186	93	37
328X1	372	298	244	122	49
328X4	275	220	180	90	36
			( 00)	( - E)	( h)
	(slots)	(x.8)	(x.82)	(x.5)	(x.4)

## Supply Requirements

Unlike the number of discrepancies and repair times, the time required for off-base supply has been investigated previously. Holck and Ticknor used data, supplied by MAC, to derive a tabular distribution for supply times (Ref 8:38). This is a single distribution for all spare parts, and it may or may not be accurate for a detailed study of the supply function. However, this study concentrates solely on the effects of manning. Since the probability of requiring spare parts, and the associated supply delay time, determine whether the maintenance men can complete a job or have to wait for the spare parts to arrive, this distribution directly affects the pattern of manning utilization.

As will be discussed in detail in the experimental design section, this maintenance model is substituted into Holck and Ticknor's simulation, and manning is tested for its effect on the overall airlift system. If the supply distribution is also changed, the effect of different manning levels would be confounded with the effect of a different supply distribution. Conversely, if the supply distribution is not changed, any difference in the significance of manning would be directly attributable to the manning model. Therefore, this model will use the same distribution of supply times as Holck and Ticknor used.

#### Summary

This chapter identified the elements of the conceptual

model that required quantification, so that a mathematical model of the maintenance system could be developed. The requirement to model at the subsystem and discrete AFSC levels prevented the use of previously derived distributions of numbers of discrepancies and repair times. Shaw's equations are used to determine the discrepancies encountered, based on sortie length. Repair times are drawn from distributions that are estimated for each subsystem. Every subsystem, on each aircraft, could be modeled in this manner, but only the ten most critical subsystems, on the C-141 and C-5, are included in this model. This tailors the model to a wartime scenario and keeps the model small enough for ease of computerization, without sacrificing the detail required for investigation of the inner processes in the maintenance function. The maintenance force was separated into effective maintenance teams available, by AFSC, and the probabilities of using each AFSC were estimated by analysis of historical data. Finally, the supply requirements are modeled exactly as previously derived in Holck and Ticknor's simulation. With a mathematical representation of these elements, the model is ready to be computerized, and that process is the subject of the next chapter.

## V <u>Computerization</u>

#### Introduction

Since mathematical notation is the basic language of the computer, translating the mathematical model of the previous section into a computer-consumable product is the next logical step in the simulation process (Ref 20:302). The particular computer language, selected for this translation process, determines the ease with which the translation is made and how well the structure and logic of the system can be represented in the computer program. This chapter details selection of the computer language, the general approach taken in developing the model, the specific form of the model, and verification of the model. As a whole, this chapter is a description of the tool, in the form of a computer model, used to analyze the maintenance system.

# Language

A special purpose simulation language has the advantage of incorporating the common functions associated with describing a system. Creation of random numbers and variates, mechanisms for time advancement, formatted data output, and debugging mechanisms are only a few of the features built into a special purpose language for ease of programming (Ref 20:107). SLAM, Simulation Language for Alternative Modeling, (Ref 16) was chosen to model the maintenance system because of its flexibility and the usefulness of its built-in functions.

The network portion of SLAM easily models the queuing situation found in the allocation of maintenance resources to aircraft. Additionally, the symbolic representations of the SLAM network (Ref 16:130) provide a visual representation of the logic of the flow through the maintenance system. Reliable random number generators support the requirement for conditional branching, and verified random variate generators can provide the repair times. SLAM's clock mechanism can handle either the discrete event orientation or continuous flow. Very importantly, the built-in statistical analysis and output formats allow easy interpretation of the flow processes, one of the primary objectives of this study. Finally, the trace option is an invaluable tool in the verification and debugging processes (Ref 16).

## SLAM Terminology

SLAM provides a framework, the network structure of nodes and branches, for modeling the flow of entities through a sequence of events, activities, and decisions (Ref 16). This section describes the individual network symbols used to describe the maintenance system in this thesis. The descriptions are brief and only meant to give the reader, who may be unfamiliar with SLAM, a general understanding of the network symbols and their functions.

Attribute. Attributes are values assigned to individual entities. These values are carried through the network to distinguish each individual entity. For example, the time that an entity entered the network can be carried as an attribute, often referred to as the mark time. Also, arbitrary numerical values can be assigned to designate an entity as a specific type. A C-141 might arbitrarily be designated by placing a vlue of one in an attribute, to distinguish it from a C-5 that would have a value of two in the same attribute.

Resource. Situations arise where an entity requires some item, servers or equipment, that must be carried through a portion of the network. These items are designated as resources and are put into the model in limited quantities.

Activity. Activities are the actual paths over which the entities move. They are the only place that explicit time delays occur, such as the time delay while maintenance is being accomplished. There does not have to be a time delay associated with an activity, but each activity must have a beginning and an ending node. Thus, the nodes represent a point of interest where an activity is starting or has just ended. Additionally, several activities can emanate from a single node, representing branching. One of three situations can be depicted with branching. First, all branches can be taken by duplicating the entity and routing one of the entities along each of the branches. Second, a probability can be assigned to each of the branches and the path of the

entity will be determined probabilistically. Finally, conditions can be specified for each of the branches. Then, when an entity arrives, a duplicate of the entity will take each branch for which the condition is satisfied.

GOON Node. The GO ON or GOON node accomplishes no particular function, other than providing a break point between sequential activities. It is most often used as the point to begin branching, after some other activity.

Assign Node. The Assign node is used to assign values to the attributes of the entity passing through the node or to assign values to system variables. Attributes have already been discussed, and system variables are designated by XX(I), where I is an integer. The system variables are similar to any designated variable in FORTRAN, but they can be used in the network, a function, or a subroutine.

Await Node. Await nodes are used to assign resources to the entities that pass through the node. If resources are available, they are assigned to the entity and it continues through the network. If all resources are being used, the entity waits at the node until resources become available. Then, the resources are assigned and the entity continues through the network.

Free Node. The free node is used to take resources from an entity and make them available for assignment to the next entity at an await node.

Queue Node. Queue nodes represent the waiting lines for service. Normally, an entity will enter a queue node and wait there until some server, in a following activity, is available. However, in this model, the queues are used as simple waiting lines, controlled by a match node. There are no service activities following the queues.

Match Node. The match node controls several queues. It follows the queues, in the network, and searches the entities waiting in the queues for particular values of a designated attribute. When every queue that is controlled by the match node has an entity with that particular value in its designated attribute, all of those entities are allowed to proceed in the network.

Accumulate Node. The accumulate node releases one entity to proceed in the network, when a prescribed number of entities have arrived to it. It is used in this thesis to combine the subsystems of an aircraft, when they are matched by the match node, into a single aircraft.

Event Node. The event node allows the modeler to design a function not specifically included in any of the other SLAM nodes. The arrival of an entity at an event node causes subroutine EVENT to be called. This is a FORTRAN subroutine that supplements the SLAM network by allowing the modeler to include extensive mathematical equations or perform some logic not provided by any other node. The

attributes of the entity can be changed in the subroutine, and when the subroutine has run, the entity continues in the network.

<u>Function USERF</u>. The USERF function is a user-defined FORTRAN function. It can be called from the network or a subroutine, and it returns a single value stored in the memory location called USERF.

These descriptions are not complete and do not represent all of the capabilities of the SLAM network, but they should suffice to acquaint a casual reader with the terminology used in the description of the model. The full capabilities of the SLAM language were not exercised in this model, so only the appropriate parts were discussed. For a more detailed explanation, the reader is referred to <u>Introduction to Simulation and Slam</u> (Ref 16).

## General Approach

The flexibility of the SLAM language allows the system to be modeled as a network, within which, the event nodes are used to model the complex operations not provided by any other SLAM node (Ref 16:316). Thus, determination of numbers of discrepancies, using Shaw's equations, can take place within an event. As mentioned before, supply times are determined in a FORTRAN function, so any other distribution could easily be substituted. Both of these functions occur within an event node so an entity leaves that single node with all the information required in the maintenance network.

By determining all the requirements in an event, the rest of the network can directly model the logic of the flow through maintenance. As will be shown, the network presents a one-for-one matching of network portions with the logic steps developed in the conceptual model. This approach makes it easier to follow the logic in the model and should increase confidence in the fact that the computer model accurately reflects the conceptual model.

As a useful tool, this model of maintenance is designed to be incorporated into a larger simulation of strategic airlift, acting as an input-output system. Thus, the basic model begins at a single node in a network, where an aircraft arrives as the input to the maintenance model. The output is also a single node where the mission-ready aircraft will depart the maintenance system. However, for the development and initial testing of the model, an artificial input and output were designed.

Appendix A lists the SLAM statements and FORTRAN code that make up the actual computer model. Since the maintenance model is to be used in a larger simulation of the airlift system, some of the information required by the maintenance model would have normally been generated in other portions of the airlift system. A unique mark time in attribute 1, a numerical designator for type of aircraft in attribute 2, and the sortie lengths for the outbound and return sorties in attributes 3 and 4, respectively, are provided in the basic model, in lines 3650 to 3730. These four pieces

of information are the only requirements for processing in the maintenance model. Additionally, an aircraft leaving maintenance would normally return to the airlift system, but, in the basic model, statistics are collected and the entity is terminated in lines 6210 to 6230.

#### **Events**

An aircraft enters the maintenance system at the node labeled GO1, line 3740. The breakdown to ten separate subsystems (see Figure 10) is represented by routing entities along all ten branches, lines 3750 to 3840, to the event nodes. All ten of the events are identical, except for the parameters X1, X2, Y1, and Y2 (see Appendix A: lines 430-2360). Attribute 5 is set equal to the event number to identify each subsystem, the parameters are set, and the entity proceeds to line number 2420, where the computations begin. X1 and X2 are the "A" and "B" of Shaw's equations and are used in line 2420, with the outbound sortie length, to get the expected number of failures on that sortie. Then, the expected number of failures is used as the mean of a Poisson distribution, line 2470, to get the actual number of failures. This process is repeated for the return sortie in lines 2510 to 2560, to get the total number of failures in a subsystem.

If no failures occur, attribute 3, maintenance time, and attribute 4, supply time, are both set to zero (lines 2600-2630). If any failures occurred, a maintenance time

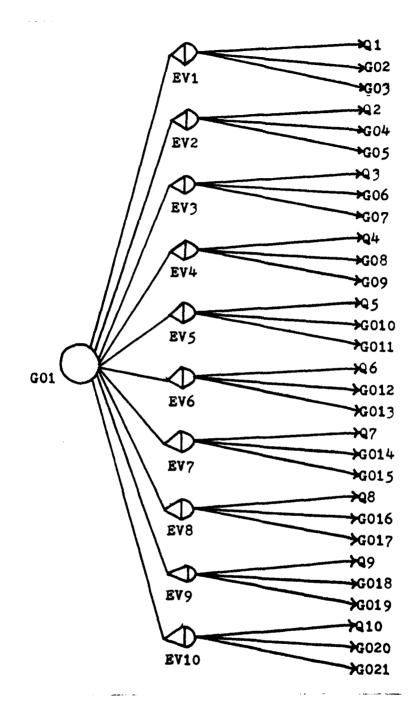


Fig 10. Entry Node, Events, and Initial Branching

is taken as a random variate from a gamma distribution with parameters Y1 and Y2, at line 2700. Lines 2740-2770 adjust that maintenance time for multiple failures. Only one maintenance team will be assigned to each subsystem, so more time will be taken as the number of failed parts increase. There is no data available for the effect of this assumption, so the time increase factors are arbitrary. They represent the assumption that troubleshooting and actual repair time will increase, as the number of failed parts increase. After four components, any more will require negligible time, since a large portion of the subsystem would be dismantled to replace four components.

If any components failed, a call is made to the supply user function, and the supply delay is returned at line 2810. This delay time represents the off-base supply action. Since parts would have to be ordered and delivered, not all of the maintenance time can be accomplished at once. Thus, if there is a supply delay, the maintenance time is divided in half, line 2870. When the subsystem returns to the network portion of the model, it will be assigned personnel and go through a maintenance activity two separate times. The first time through, half of the original maintenance time will be spent simulating the troubleshooting and removal of the bad part. Then the supply delay occurs, and the second time through maintenance represents the last half of the original maintenance time, to replace and test the part.

# Supply Function

The supply function, as discussed previously, is derived from historical data. It consists of a separate, tabular distribution for each aircraft, lines 3100-3450. However, lines 3050 and 3060 are included as control statements. On line 3050, only a fixed percentage of candidates are given a supply delay. This percentage is set, in the model, at 25 percent, and it represents the analyst's best estimate of the Not Mission Capable due to Supply (NMSC) rate. The other control feature, line 3060, allows the analyst to set a time, before which supply will not be a factor. This represents the use of war reserve material, stockpiled on the base, and the analyst must estimate how long those supplies will last. Regardless, the end result is that the supply delay, zero or greater, is returned to the event that called the user function.

#### Network

Once the entity completes an event, the subsystem has its maintenance time set in attribute 3 and its supply time in attribute 4. The portion of the network, between event node and a queue, makes the logic decisions of the conceptual model. As each subsystem departs its event, it follows one of three paths. If there were no discrepancies, maintenance time is zero, and the subsystem proceeds directly to its appropriate queue to wait for completion of maintenance on all ten subsystems. Otherwise, if the aircraft is a C-141, it

55

goes to the first GOON node listed; and if it is a C-5, it goes to the second GOON node (see Figure 10).

At these GOON nodes, all of the subsystems follow the same pattern of logic, so only the first subsystem, that went through Event 1, will be shown. Lines 3860-3880 of Appendix A show the conditional branching to the GOON nodes or the queue. An expanded view of this process, for Event 1, is shown in Figure 11. At GO2, a probabilistic decision determines the AFSC required to fix the discrepancy on a C-141. The probabilities come form Table IV in Chapter IV, and AW1 and AW4 represent the await nodes where the AFSCs are allocated to the subsystems. The branch going to GO22 represents the case when an AFSC that has not been modeled is required. Since an infinite resource of those AFSCs is assumed, the await nodes are bypassed and maintenance takes place on the way to GO22. The code for these decisions is on lines 3890-3920. Likewise, the decisions for a C-5 are represented on lines 3930-3970.

Since all of the maintenance resource sub-networks are exactly the same, except for the particular AFSC being used, only the sub-network using 431R2 AFSC will be explained. This portion of the network is shown in Figure 12, and it corresponds to lines 5170-5230 in Appendix A. When any one of the subsystems determines that it needs a flight controls specialist, the subsystem is sent to the await node, AW1. If there is a maintenance team available, maintenance begins

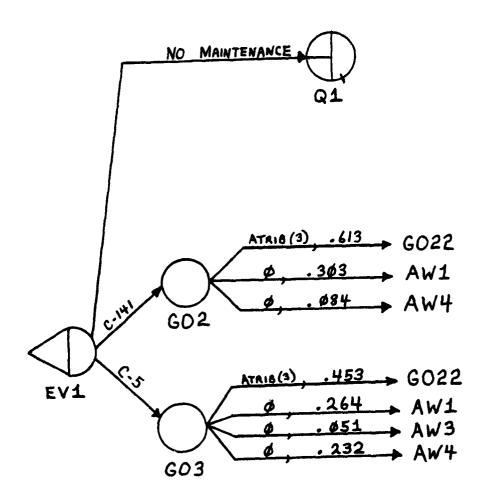
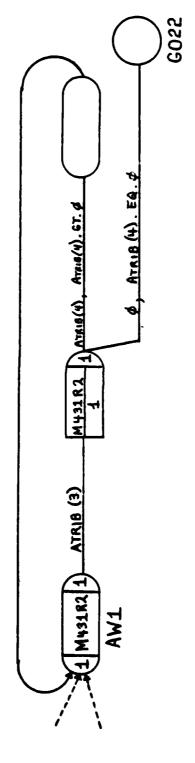


Fig 11. Expanded View of Initial Branching



F1g 12. Resource Subnetwork

and proceeds for the time specified in attribute 3. Then, the team is freed, and if there was no supply delay, the subsystem goes to GO22. If there was a supply delay, the maintenance is only half completed. The supply delay occurs, and supply time is set to zero at the assignment node, thus preventing the subsystem from continuing in an infinite loop. The subsystem goes back to have a maintenance team allocated again, goes through the second half of its maintenance, frees the personnel, and goes to GO22.

All of the resource sub-networks follow the same pattern; so, unless a subsystem had no maintenance and went directly to its queue, all of them eventually get to GO22. Figure 13 shows the possible paths to this point, for a subsystem going through Event 1. A subsystem, arriving at GO22, could have come from one of the resource sub-networks or directly from an event, if no modeled resources were needed. If the subsystem came from a sub-network, any supply delay will have already been incurred, so the subsystem is routed directly to GO23 (see Figure 14). If it came from an event and had a supply delay, that delay plus the second half of its maintenance are accounted for on the way to GO23. This logic is listed in lines 5940-5970 of Appendix A.

Departing GO23, only one branch is taken, with the conditional branching depending on the value in attribute 5. That value was set equal to the event number, so each subsystem arrives at its appropriate queue (lines 5980-6170).

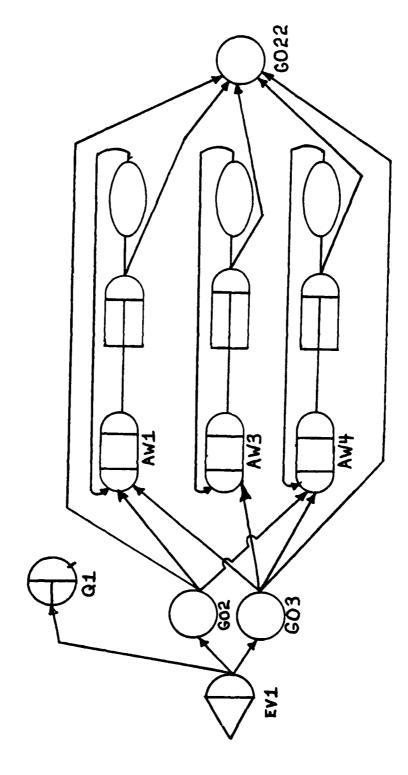


Fig 13. Possible Paths from Event 1

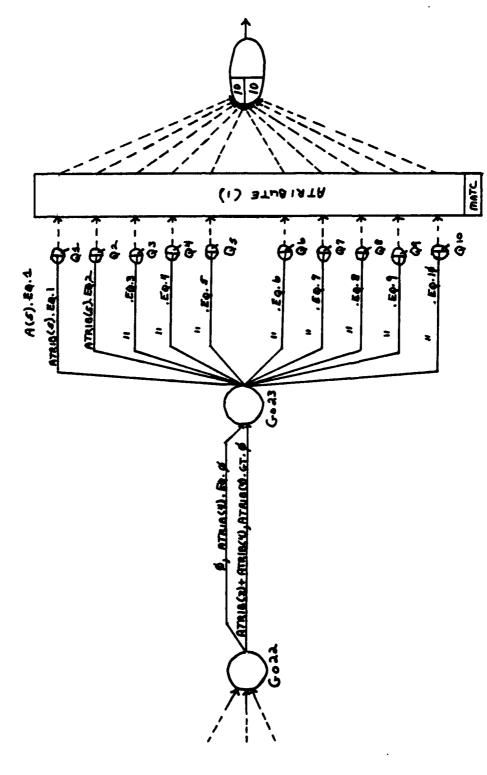


Fig 14. Reassembly of Subsystems

When all ten subsystems have completed maintenance, the match node matches the mark times of the ten subsystems and sends them to the accumulate node (line 6180). At line 6200, the ten subsystems are reassembled into a single entity, and the mission-ready aircraft departs the maintenance system.

#### Verification

The model, as represented in Appendix A, was verified through the use of the trace option in SLAM (Ref 16:156). The traces provide a detailed output of the step-by-step process of running the simulation. Every possible path through the network was followed, to ensure that the logic and execution were correct. The computer program does execute as the logic was intended. All conditional branching, matching, and accumulation work as planned. In addition, the validity of the probabilistic branching and random variate generators has been previously established for the SLAM program. Thus, this model is an accurate translation of the conceptual and mathematical models.

#### Summary

SLAM offers a simulation language that is almost perfectly suited to translate the mathematical model of Chapter IV into a computer model. The program, as translated, was presented with the coding in Appendix A and the symbols shown throughout this chapter. As demonstrated, the symbolic representation of the model duplicates the logic presented in

Chapter III, and the built-in functions of SLAM allow easy translation of the mathematical processes. The trace option allows thorough testing to ensure that the program functions as was intended. As a result, the computer model now represents a useful tool with which to continue this study of the maintenance system. The next chapter describes the manner in which this tool was applied to conduct this investigation.

## VI Experimental Design

#### Introduction

The computer model is a tool and nothing more. Although the development of the computer model was the first objective of this thesis, the other three objectives are equally important. In order to test the implicit assumptions of the universal maintenance man concept and determine the significance of maintenance manning on the airlift system, the model is used in place of the actual system. By experimenting with the model and analyzing the results, some inferences about the actual system can be drawn. This chapter explains the design features incorporated into the computer model to aid in investigating the assumptions of the universal maintenance man concept, as well as the experiments designed to test those assumptions. Each of the last objectives of the thesis is discussed, in turn. The experiments for each objective are developed, and the results of the experiments are analyzed. Finally, the methods of variance reduction, incorporated into the model, are explained.

### Proportionality

As Shannon suggests, the role of experimental design comes into play in both the planning and execution stages of model development (Ref 20:149). With a well planned idea of the experiments to be conducted, the model can be developed specifically to output appropriate statistics and to make

the execution of the experimental design more efficient.

Although this chapter follows the development of the computer model in this thesis, the experimental design was an important input in planning the development of the computer model.

One example of this prior planning is the ability to analyze the pattern of manpower utilization in maintenance. Since the universal maintenance man concept implicitly assumes that the manpower will be used in exact proportion to the established manning levels of the specialists, this assumption can be tested by direct reference to utilization statistics. By modeling each AFSC as a separate resource, controlled by an await node, SLAM provides statistics on the utilization of each AFSC and any delays due to the non-availability of any AFSC (Ref 16:159-161). Thus, on any run of the model, these statistics can be observed. If the implicit assumption is realistic, those statistics should show approximately equal utilization of each AFSC and no delays until nearly 100 percent of the maintenance force is being used.

SLAM outputs the actual number of resources used (Ref 16:161), and those numbers fluctuated from run to run. However, when converted to percentages of resource capacity, none of the runs ever approached an equal distribution of requirements. Table VI shows the percent utilization of each AFSC, as a representative sample of a run of the model. These are percentages of the number of teams available, for each

TABLE VI
Percent Utilization of AFSCs

AFSC	Average	Maximum
431R2	7%	28%
431W2	23%	100%
423X0	12%	49%
423X4	17%	75%
426X2	3%	13%
423X1	1%	9%
423X3	4%	32%
325X1	21%	89%
325X0	2%	24%
328X1	10%	49%
328X4	9%	75%

AFSC, and they show a wide disparity in useage. The average values vary from one percent to 23 percent, and the maximums vary from nine percent to 100 percent. These figures suggest that maintenance manpower is not used in exact proportion to the established manning levels of the specialists. Actually, the useage is very much disproportional.

### 100 Percent Utilization

As seen in Table VI, the initial runs of the model did not produce 100 percent utilization of the entire maintenance force. At the maximum, only one of the 11 AFSCs was fully utilized. Since the universal maintenance man concept requires all of the maintenance force to be busy before any delays occur, it is important to determine whether full utilization is feasible. The fact that 100 percent utilization did not occur in the initial runs of the model does not prove that it cannot occur. A slightly different pattern of aircraft arrivals might change the pattern of determining numbers of discrepancies and the associated AFSCs required to fix them, and 100 percent utilization could result.

In order to test the possibility of full utilization of the maintenance force, an experiment was designed to try to force maximum use of the maintenance force. The model was artificially set up to introduce a constant stream of aircraft, at very close time intervals, into the maintenance system. A total of 350 aircraft, more than the current total

number of strategic airlift aircraft, were input to the model. As soon as the aircraft completed maintenance, they were routed back to the input node with a new set of input parameters. Three separate runs, with different seeds, were made in an attempt to saturate the maintenance model and force 100 percent utilization. Using different seeds, resulting in different random number streams, decreased the possibility that a non-representative outcome would be reported. However, the results were essentially the same for all three runs, and only one run will be presented here.

At the end of 120 hours of simulation time, the landing gear and instrument specialists were all working. The landing gear specialists, 431W2, had 66 subsystems waiting in their queue; and the instruments specialists, 325X1, had 179 subsystems in their queue. No other specialists were experiencing any backlog of jobs. The percentage utilization of each AFSC is presented in Table VII. Even at this unrealistically high demand rate, 100 percent utilization of the maintenance force is not achieved. The AFSCs in high demand tend to stop the flow of aircraft, before full utilization of the other AFSCs can be attained.

This result implies that 100 percent utilization of the maintenance force is not feasible, but it is still not conclusive proof. However, if full utilization cannot be attained under these unrealistic conditions, the possibility of it being attained under normal conditions is very small.

TABLE VII

Percent Utilization of AFSCs, Maximum Effort

AFSC	Average	Maximum
431R2	35%	82%
431W2	99%	100%
423X0	40%	100%
423X4	91%	100%
426 <b>X</b> 2	14%	37%
423X1	4%	11%
423X3	16%	43%
325X1	99%	100%
325X0	12%	41%
328X1	53%	100%
328X4	55%	100%

Thus, any simulation that requires 100 percent utilization before any delays occur, such as the case when universal maintenance men are used, would not correctly reflect the maintenance system.

# Significance of Maintenance Manning

The last objective of this thesis is to determine the significance of maintenance manning on the airlift system. Since the implicit assumptions of the universal maintenance man concept do not realistically represent the actual maintenance system, the effects of maintenance manning may have been incorrectly assessed in previous simulations that used universal maintenance men. With the maintenance model, developed in this thesis, included in a simulation of the airlift system, a more accurate assessment of the effects of maintenance manning can be made. This section details the selection of an appropriate simulation of the airlift system within which the effects of the maintenance model could be tested, and the experimental design and results of that test are discussed.

The best and most meaningful experimentation would come from including this model in a large simulation, like M-14, that represented a network of bases. This would allow the maintenance force to be dispersed and the ripple effects, through the bases, could be analyzed. However, M-14 is not yet developed and debugged to the point where anything but unlimited maintenance resources have been used. Thus, it is

not possible to conduct a large-scale experiment with multiple bases. However, Holck and Ticknor developed a simulation of airlift capability (Ref 8), and their doubts about the validity of the maintenance portion of their model partially prompted this investigation of the universal maintenance man concept.

In their simulation, Holck and Ticknor modeled the resupply of Europe, using aggregate bases in the United States and Europe. In early runs of their model, only 65 percent of the maintenance force was ever used at one time, and since they used universal maintenance men, no delays were ever seen. Thus, manning had no effect on their measure of airlift capability, total tons delivered in 30 days. Using a  $2^{k-p}$  fractional design, they determined that time to zero War Reserve Material (WRM) and the number of aircraft available were the only statistically significant factors in their model. Additionally, resupply time appeared to have some influence (Ref 8:74).

Since Holck and Ticknor did use universal maintenance men, did not find maintenance manning significant, and did not think that the results of the maintenance portion of their model were realistic, their simulation was chosen to test the maintenance model developed in this thesis. By substituting this maintenance model for the maintenance portion of their model, without changing any other part of their model, any difference in the outputs would be directly

attributable to the more detailed modeling of maintenance manning. As previously mentioned, the distribution of resupply times, used in this thesis model, was taken directly from Holck and Ticknor's simulation. Thus, any changes in outputs would not be due to a different resupply distribution. Again, this was done to isolate only the effects of maintenance manning.

Holck and Ticknor's simulation, with the maintenance model developed in this thesis substituted for their maintenance portion, is listed in Appendix B. In a simulation of the entire airlift system, there are many factors that might have a significant effect on the capability of the airlift fleet to deliver cargo. However, Holck and Ticknor determined that, in their model, only three factors were significant. This study is particularly concerned with the effect of a fourth factor, maintenance manning. Thus, only four factors were tested in the experimental design. Each factor, number of aircraft, time to zero WRM, resupply time, and maintenance manning levels, was initially set at the level expected for the scenario. Then, each factor was changed to a second experimental level to determine the effect of such changes.

Again, to keep the conditions of this experiment as close as possible to Holck and Ticknor's original experiment, their initial and experimental levels were used for number of aircraft, time to zero WRM, and resupply time. Initially,

176 C-141s were used, and the experimental level was changed to 229, representing the increased capacity of the stretched C-141B. The initial resupply times, reflected in lines 5550 to 5970 of Appendix B, were experimentally reduced by 23 percent to represent the expected slowdown in supply channels during wartime. Finally, the time to deplete the stock of WRM was initially determined to be 12 days. The experimental level was set at 24 days, reflecting a buildup of prepositioned supplies (Ref 8).

Since manning is the only factor not previously tested, the levels used will be explained. The initial level is the structure as derived in Chapter IV (see Table V). This structure represents the maximum number of effective maintenance teams currently available. For testing purposes, the alternate level was established as 90 percent of the initial teams available. This ten percent reduction is realistic, because not all of the strategic airlift aircraft are used in Holck and Ticknor's simulation. Some aircraft are dedicated to previously committed missions, and a portion of the maintenance men would be used to support those missions. Also, the number of effective teams available is directly related to current manning levels, which fluctuate with recruiting effectiveness.

In order to determine the effects and interactions of these changes, a 24 full factorial design (Ref 16:164) was required. Each distinct combination of initial and

changed levels of the four factors was run twice, with different random number streams, so a total of 32 runs of the simulation were made. The data from these runs was analyzed by a four-way ANOVA using SPSS (Ref 14:410). Holck and Ticknor had demonstrated that three-way and higher interactions were negligible, so only the main and two-way interactions were analyzed.

Table VIII shows the results of the experimental runs of the simulation. Under the factors, a "-" represents the initial level of the factor, and a "+" represents the experimental level. The sixteen runs represent the 2 full factorial design, and each combination of levels gave two observations, the normal and antithetic runs. The first observation used a normal random number stream, and the antithetic run used a stream that consisted of the complements of the normal random numbers (1 - normal random number) (Ref 16:150). The effect of this antithetic sampling will be discussed later in this chapter under variance reduction. The measure of effectiveness, in the model, was thousands of tons of cargo delivered, and the outcomes are listed for each run.

These results were input to SPSS and the four-way ANOVA was run. Table IX shows the results of that ANOVA. As can be seen by the very small F-value, changing the manning level had very little effect on the output of the air-lift system. This is not a result of not having delays due to manning. Delays were shown on all of the runs using

TABLE VIII
Results of Experimental Runs

# FACTORS

	War				V 2	A 4. 4
Run	Reserve <u>Material</u>	Aircraft	Supply	Maint	Normal Seed	Anti Seed
1	-	-	-	-	126.8	132.2
2	-	+	-	-	150.9	152.1
3	-	+	<b>,+</b>	-	158.5	161.7
4	-	+	+	+	158.2	159.5
5	+	+	+	+	183.3	185.7
6	-	-	-	+	126.9	132.2
7	-	-	+	+	134.7	137.2
8	+	-	+	+	158.7	160.7
9	-	-	+	-	134.3	137.2
10	+	-	+	-	156.9	160.7
11	+	+	+	-	183.9	186.9
12	-	+	-	+	148.7	153.7
13	+	+	-	+	182.0	185.6
14	+	-	-	-	156.7	160.0
15	+	+	-	-	183.2	186.5
16	+	_	_	+	157.1	160.0

TABLE IX

ANOVA Results

Source of Variation	Sum of Squares	DF	Mean Square	<u>F</u>	Signif of F
Main Effects	10969.061	4	2742.265	598.754	.001
WRM	6135.550	1	6135.550	1339.653	.001
C-141	4706.925	1	4706.925	1027.723	.001
Resupply	126.000	1	126.000	27.513	.001
Maint	.578	1	.578	.126	.726
2-Way Interactions	107.869	6	17.978	3.925	.009
WRM C-141	18.758	1	18.758	4.096	.056
WRM Resupply	84.825	1	84.825	10.521	.001
WRM Maint	.025	1	.025	.006	.941
C-141 Resupply	1.320	1	1.320	.288	.597
C-141 Maint	2.940	1	2.940	.642	.432
Resupply Maint	.000	1	.000	.000	.993
Explained	11076.931	10	1107.693	241.857	.001
Residual	96.179	21	4.580		
Total	11173.110	31	360.423		

regular seeds, and nine of the antithetic runs also showed some delays. Apparently, in this model, these delays do not cause enough disruption of the system to significantly affect the outcome.

### Variance Reduction

The simulation model, as listed in Appendix B, uses the built-in features for variance reduction in SLAM. The paired smaples for the experimental design were obtained using antithetic sampling, as SLAM suggests (Ref 16:485). The first observation was obtained using normal seeds for the random number generators. The second observation, however, used the antithetic seeds, including a negative correlation between the observations. This process is initiated by specifying a negative initial seed value in SLAM, and it seems to be an effective method of variance reduction (Ref 16:485).

Both Holck and Ticknor's model and the maintenance model can incorporate another feature for variance reduction, correlated sampling. Each of the random number streams, provided by SLAM, is used exclusively for one purpose. In other words, every call to a random variate generator or a random number generator uses a different stream. By specifying the same seeds for different runs, the same series of events can be introduced to both runs. However, the use of both antithetic sampling and common streams can increase the variance, so extreme care must be used if both techniques are utilized (Ref 16:487).

# Summary

The experimental design used in this thesis was considered early in the development of the maintenance model to structure the output statistics and the inputs to the model. Using the model as a tool, specific tests were developed to satisfy each of the objectives of this study. Both the basic model, Appendix A, and Holck and Ticknor's simulation with this maintenance model included, Appendix B, were used in those tests. The results of those tests do not support the implicit assumptions of the universal maintenance man concept; and in a simulation that uses aggregated bases, maintenance manning levels do not appear to be statistically significant to airlift capability. The conclusions and recommendations, resulting from these findings, will be presented in the next chapter.

# VII Conclusions and Recommendations

The primary goal of this thesis was the investigation of the implicit assumptions of the universal maintenance man concept. In order to conduct this investigation, a great deal of effort was expended in developing a more detailed model of the maintenance system so the internal processes could be analyzed. The model is not a complete and universally acceptable representation of the maintenance system, but it is offered as an approach to modeling and a general guide to methodology. The model does suffice as a tool for investigation of the nature of the internal processes in maintenance, and those processes are the basis of the implicit assumptions of the universal maintenance man concept.

#### Conclusions

The results of this study are clear enough to draw several conclusions. First, the maintenance system does not operate in a manner that supports the implicit assumptions of the universal maintenance man concept. Discrepancies do not occur in proportion to the numbers of maintenance specialists capable of repairing them. Also, 100 percent utilization of the maintenance force does not appear to be feasible.

If maintenance manning is to be modeled, in a simulation that requires details of the maintenance process, the approach used in this thesis will provide sufficient details of manning utilization and possible delays. However, it is

not clear that maintenance manning must be modeled at all.

In Holck and Ticknor's simulation, maintenance did not have any significant effect. This suggests that it may be possible to delete maintenance manning from a model of strategic airlift.

#### Recommendations

The approach to modeling the maintenance portion of a strategic airlift simulation, developed in this thesis, is a viable alternative to the use of universal maintenance men. It is not as large and compelx as the Logistics Composite Model, but it will provide some level of detail concerning the maintenance function. If a simulation of strategic airlift requires detailed maintenance statistics, this approach is suggested.

Finally, each simulation effort should determine the likely effects of delays due to maintenance manning. If those effects will not be significant, for the purpose of that particular model, maintenance manning may not have to be modeled. If manning is not modeled, it may be possible to represent the total time in maintenance by one distribution of maintenance times.

### Further Research

The effects of this maintenance model, in a simulation that uses a network of bases, has not been determined. The fact that the maintenance force will be unevenly

distributed among many bases could change the significance of manning. The next logical step, in this area of research, would be to develop a network model of the MAC bases and try to incorporate this model into the network.

Also, the maintenance data tapes, as discussed earlier, are extremely difficult to use. If a program could be developed that would accomplish the basic functions of the CDEP and have variable output formats and contents, it would be a great aid for future researchers.

### Bibliography

- 1. AFM 2-21. Aerospace Operational Doctrine--United States
  Air Force Strategic Airlift. Washington DC: HQ, United
  States Air Force, 13 July 1972.
- 2. AFT 39-1 (C10). Airman Classification Regulation. Washington DC: HQ, United States Air Force, 31 October 1981.
- Bankey, Steven. Air Force Maintenance, Supply and Munitions Team. Wright-Patterson AFB, Ohio. (Personal interview).
- 4. Begin, Charles. MAC Maintenance Data Tapes. ASD/ENESA, Wright-Patterson AFB, Ohio. Telephone 255-2837.
- 5. Brown, Harold. <u>Department of Defense Annual Report Fiscal Year 1981</u>. Washington DC: United States Printing Office, 29 January 1980.
- 6. Coan, Major Stuart W. AU-20 Guide to Operation Planning. Maxwell AFB Alabama: Air University, 1980.
- 7. ---- Guidelines for Model Evaluation. (exposure draft). PAD-79-17. Washington DC: United States Government Accounting Office, January 1979.
- 8. Holck, Captain Eric K. and Captain Robert W. Ticknor.
  "Strategic Airlift: United States to Europe." Unpublished
  MS thesis. School of Engineering, Air Force Institute
  of Technology, Wright-Patterson AFB, Ohio, March 1981.
- 9. Kowalsky, Thomas. "M-14 Baseline Model Operation--Shea Study (Phase I)." Background paper, HQ MAC/XPSR, Scott AFB, Illinois, 11 March 1981.
- 10. Law, Averill M. <u>Simulation Modeling and Analysis</u>. New York: McGraw-Hill Book Company, Inc., 1982.
- 11. MACR 23-2 (C1). Headquarters Military Airlift Command Organization and Functions. Scott AFB, Illinois: Military Airlift Command, December 1976.
- 12. McGrath, E. J. et al. <u>Techniques for Efficient Monte Carlo Simulation</u>, <u>Volume I: Selecting Probability Distributions</u>. DTIC Document. Springfield, Virginia, March 1973. (AD-762-721).

The state of the s

- 13. Naylor, Thomas H. and J. M. Finger. "Verification of Computer Simulation Models," <u>Management Science</u>, 14 (October 1967).
- Nie, Norman H. et al. <u>SPSS: Statistical Package for the Social Sciences</u> (Second Edition). New York: McGraw-Hill Book Company, 1975.
- 15. ---- SPSS Update. New York: McGraw-Hill Book Company, 1979.
- 16. Pritsker, A. Alan B. and Claude Dennis Pegden. <u>Introduction to Simulation and SLAM</u>. New York: John Wiley and Sons, 1979.
- 17. Sargent, Robert G. "Validation of Simulation Models," <u>Proceedings of the 1979 Winter Simulation Conference,</u> <u>IEEE, 1979.</u>
- 18. Scarborough, SMSGT George. HQ MAC/XPSR, Scott AFB, Illinois. (telephone conversation). Telephone Autovon: 638-5560.
- 19. Schoderbek, Charles G., Peter P. Schoderbek, and Asterlos G. Kefalas. <u>Management Systems Conceptual Considerations</u>. Dallas: Business Publications, Inc., 1980.
- 20. Shannon, Robert E. Systems Simulation the Art and Science. Englewood Cliffs: Prentice-Hall, Inc., 1975.
- 21. Shaw, Christopher C., Jr. "Determination of Spare Parts Requirements for Strategic Airlift Aircrafts Through an Analysis of Major Aircraft Systems" (tentative title). Unpublished proposal for a dissertation, University of Nebraska-Lincoln, Lincoln, Nebraska, August 1980.
- 22. ---- "Saber Sustainer." Unpublished text of a briefing to the Air Staff, HQ United States Air Force, Washington DC, March 1981.
- 23. T.O. 1C-141A-06. Workunit Code Marual, USAF Series C-141A and C-141B Aircraft. Washington DC: HQ, United States Air Froce, 1 January 1981.
- 24. T.O. 1C-5A-06. Workunit Code Manual, USAF Series C-5A Aircraft. Washington DC: HQ, United States Air Force, 1 April 1981.
- 25. Van Horn, Richard. "Validation." In <u>The Design of Computer Simulation Experiments</u>. Edited by Thomas H. Naylor. Durham, North Carolina: Duke University Press, 1969.

The second secon

26. Walpole, Ronald E. and Raymond H. Myers. <u>Probability</u> and <u>Statistics for Engineers and Scientists</u> (Second Edition). New York: Macmillan Publishing Co., Inc., 1978.

- which was a

Appendix A
Basic Maintenance Model

```
WPS+CM265888,T158,10188. T818372+STANBERRY:BOX4577
                                                                           868188
ATTACH.PROCFIL.SLAMPROC.ID=AFIT.
                                                                           862118
                                                                           888128
FTN5.ANSI=#.
                                                                           666136
BEGIN, SLAM, MELCO, PL=18988.
                                                                           398158
                                                                           966168
C
                                                                           399179
Ç
                                                                           396186
¢
                                                                           283198
Ç
      PROGRAM MAIN (INPUT: OUTPUT: TAPE5=INPUT: TAPE6=OUTPUT: TAPE7)
                                                                           666286
                                                                           328218
      DIMENSION NSET (45000)
      COMMON/SCOMI/ ATRIB(188) +DD(188) +DDL(188) +DTNOW+II+MFA+MSTOP+NCLNR888228
     1.NCRDR, NPRNT, NNRUN, NNSET, NTAPE, SS(188), SSL(188), TNEXT, TNOW, XX(188) 888238
                                                                           888248
      COMMON GSET (45988)
                                                                           862256
      EQUIVALENCE (NSET(1),QSET(1))
                                                                           896266
      NNSET=45888
                                                                           966276
      NCRDR=5
                                                                           866288
      NPRNT=6
                                                                           288292
      NTAPE=7
                                                                           886388
      CALL SLAM
                                                                           606318
      STOP
      END
                                                                           989329
```

```
SUBROUTINE EVENT (1)
                                                                          389349
       CCMMCN/SCOM1/ ATRIB(128).ED(198).BDL(188).DTNOW.II.MFA.MSTOP.HCLMR889358
     1.NCRDR.NPRNT.NNRUN.NNSET.NTAPE.SS(188).SSL(188).TNEXT.TNOW.XX(188)8083368
       GO TO (1,2,3,4,5,6,7,8,9,10),I
Ç
                                                                          200338
C
  EVENT 1
                  SETS PARAMETERS FOR W.U.C. #11.
                                                                          202392
Ç
                                                                          88488
  ** FOR A C-141 **
Ċ
                                                                          266418
C
                                                                          388428
      ATRIB(5)=1
                                                                          863438
       IF(ATRIB(2).EQ.2) GO TO 11
                                                                          885448
      11=.0334
                                                                          388458
      X2=,$684
                                                                          289468
      Y1=.9954
                                                                          338473
      12=3.8421
                                                                          368488
      GO TO 188
                                                                          256498
                                                                          888568
  ## FOR A C-5 ##
                                                                          888513
                                                                          866526
 11
     X1=.373
                                                                          866538
      X2=.612
                                                                          888548
      11=3.8737
                                                                          088558
      Y2=.9344
                                                                          808568
      CO TO 186
                                                                          866576
                                                                         000582
C EVENT 2
                  SETS PARAMETERS FOR W.U.C. # 13.
                                                                          228598
                                                                          836656
   ** FOR A C-141 **
                                                                          886618
                                                                          969829
      ATRIB(5) =2
                                                                          868438
      IF (ATRIB(2).EQ.2) GO TO 12
                                                                          666616
      X1=.0317
                                                                          303458
      12=.6568
                                                                          533899
      11=.9815
                                                                          386476
      Y2=1.9368
                                                                         888636
      GO TO 186
                                                                         868698
                                                                         366766
  ** FOR A C-5 **
                                                                         998719
                                                                         998729
 12 X1=.614
                                                                         888738
      X2=.#35
                                                                         886748
      11=1.2269
                                                                         988758
      12=1.4696
                                                                         666766
      GO TO 188
                                                                         966776
                                                                         666786
                  SETS PARAMETERS FOR W.U.C. # 14.
C EVENT 3
                                                                         666798
                                                                         666866
  44 FOR A C-141 44
                                                                         666818
                                                                         858828
     ATRIB(5) =3
                                                                         666836
```

wall water and the sale of the

AD-A115 745

AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OH SCHOOL—ETC F/G 1/2
AN IMPROVED MAINTENANCE MODEL FOR THE SIMULATION OF STRATEGIC A.—ETC(U)
MAR 82 W P STANBERRY
AFIT/GST/OS/82M-13

NL

END

Lan

7 82

Orig

```
929812
     IF (ATRIB(2),EQ.2) G0 T0 13
                                                                         366856
     X1=.8129
                                                                         863816
     X2=.6278
                                                                         953879
     11=1.3925
                                                                         838888
     Y2=2.1242
                                                                         325895
     GB TO 196
                                                                         288988
                                                                         383918
C ## FOR A C-5 ##
                                                                         888923
                                                                         565936
 13 X1=.074
                                                                         334946
      X2=.618
                                                                         866956
      Y1=1.7996
                                                                         93994
      12=1.5665
                                                                         988978
      GO TO 188
                                                                         666986
                                                                         386998
                  SETS PARAMETERS FOR W.U.C. # 23.
C EVENT 4
                                                                         881366
                                                                         881818
  ## FOR A C-141 ##
                                                                         881828
                                                                         681638
      ATRIB(5) =4
                                                                         861946
      IF (ATRIB(2).EQ.2) GO TO 14
                                                                         261856
      X1=.6524
                                                                         861866
      X2=.0772
                                                                         961878
      Y1=.7625
                                                                         891686
      Y2=3.6644
                                                                         661896
      GO TO 166
                                                                         361168
Ç
                                                                         851115
C ## FOR A C-5 ##
                                                                         861128
Ç
                                                                         86:136
 14 11=.253
                                                                         861146
      X2=. #96
                                                                         861158
      Y1=1.1153
                                                                         881168
      12=1.6712
                                                                         661176
      CO TO 198
                                                                          661186
                                                                          661198
C EVENT 5
                   SETS PARAMETERS FOR W.U.C. # 42.
                                                                          861266
                                                                          461216
C ## FOR A C-141 ##
                                                                         061225
¢
                                                                         661236
      ATRIB(5) =5
                                                                          881248
      IF (ATRIB(2),EQ.2) GO TO 15
                                                                          861256
      X1=.6665
                                                                          961268
      12=.6676
                                                                          881278
      Y1=1.1171
                                                                          661286
       Y2=1.2157
                                                                          661296
      CO TO 186
                                                                          661366
                                                                          001315
 C ## FOR A C-5 ##
                                                                          661326
                                                                          661336
  15 X1=.118
```

```
X2=.636
                                                                        391349
      Y1=.6374
                                                                        081358
      12=2.5955
                                                                        361346
      GO TO 188
                                                                        881378
                                                                        881389
C EVENT 6
                  SETS PARAMETERS FOR W.U.C. # 45.
                                                                        661396
                                                                        981498
C ** FOR A C-141 **
                                                                        261412
                                                                        981429
      ATRIB(5)=6
                                                                        861438
      IF (ATRIB(2).EQ.2) GO TO 16
                                                                        881448
      X1=.2897
                                                                        88:458
      X2=. $292
                                                                        381463
      11=.4326
                                                                        98:476
      Y2=4.3823
                                                                        861486
      GO TO 186
                                                                        881498
                                                                        681588
C ** FOR A C-5 **
                                                                        361518
Ç
                                                                        891528
 16
    X1=.151
                                                                        881538
      X2=.#48
                                                                        881548
      Y1=,5574
                                                                        961556
      12=3.6682
                                                                        69158
      GO TO 186
                                                                        851579
C
                                                                        881588
C EVENT 7
                  SETS PARAMETERS FOR W.U.C. # 46.
                                                                        881596
                                                                        381506
C ** FOR A C-141 **
                                                                        661618
                                                                        881528
      ATRIE(5) =7
                                                                        661636
      IF (ATRIB(2).EQ.2) GO TO 17
                                                                        861646
      X1=.#12
                                                                        $$165$
      X2=.668
                                                                        661666
      Y1=1.376
                                                                        461676
      12=2.8644
                                                                        881686
      GO TO 188
                                                                        $61695
                                                                        661766
C ++ FOR A C-5 ++
                                                                        661716
                                                                        961728
 17 X1=.111
                                                                        661736
      X2=.#12
                                                                        981748
      11=.5229
                                                                       661756
      12=3.5153
                                                                       961769
      GO TO 166
                                                                       661776
                                                                       661786
C EVENT 8
                 SETS PARAMETERS FOR W.U.C. # 51.
                                                                       661796
                                                                       ##18##
C ** FOR A C-141 **
                                                                       661816
C
                                                                       661828
     ATRIB(5) =8
                                                                       661836
```

```
IF (ATRIB(2).EG.2) GO TO 18
                                                                             201846
          X1=.6218
                                                                             861858
          X2=, $181
                                                                             848188
          Y1=.12#8
                                                                             221879
         12=9.931
                                                                             281282
         GO TO 188
                                                                            361896
                                                                            981966
   C ## FOR A C-5 ##
                                                                            961918
                                                                            981928
    18 11=.122
                                                                            981936
         X2=.#49
                                                                            881948
         11=.1225
                                                                            ##195#
         12=13.9255
                                                                            28196
         GB TO 188
                                                                            861976
   ¢
                                                                            281986
     EVENT 9
                     SETS PARAMETERS FOR W.U.C. # 72.
                                                                            $$1998
   C
                                                                            992998
   C ** FOR A C-141 **
                                                                            682918
   C
                                                                            992329
         ATRIB(5) =9
                                                                            662636
         IF (ATRIB(2).EQ.2) GO TO 19
                                                                            882846
         X1=.6789
                                                                            982858
         X2=. #266
                                                                            882666
         Y1=.6439
                                                                           882$76
         12=29.5124
                                                                            692388
         GO TO 138
                                                                            882898
   C
                                                                            882168
  C ++ FOR A C-5 ++
                                                                           882118
   Ç
                                                                           882128
    19 X1=.262
                                                                           882136
         X2=.#85
                                                                           382148
         Y1=.3622
                                                                           502158
         12=4.8696
                                                                           ##216#
         GO TO 186
                                                                           882178
  C
                                                                           992189
  C EVENT 18
                    SETS PARAMETERS FOR W.U.C. 55 & 73.
                                                                           882198
  Ç
                                                                           862286
  C ** FOR A C-141 **
                                                                           662216
  C
                                                                           882228
   16 ATRIB(5)=15
                                                                           552236
        IF (ATRIB(2).EQ.2) GO TO 26
                                                                           $$224$
        X1=.6138
                                                                           682258
        12=.6126
                                                                           862268
        Y1=,1114
                                                                           #82276
        12=12.5641
                                                                           $62285
        CO TO 155
                                                                           662296
                                                                          462346
  C ++ FOR A C-5 ++
                                                                          682318
                                                                          662326
. 26 X1=.138
                                                                          992339
```

```
X2=.#63
                                                                         882348
      11=.2767
                                                                         382356
      12=7.2738
                                                                         662366
C
                                                                         222375
C ADDRESS 196
                      FIRST, DETERMINES EXPECTED NUMBER OF FAILURES
                                                                         ##238#
C FOR THE APPROPRIATE WORK UNIT CODE (USING THE PARAMETERS)
                                                                         582396
C X1 & X2, SET ABOVE), FOR THE OUTBOUND SORTIE.
                                                                         292466
                                                                         882418
 198 XX(2) = X1 + X2 = ATRIB(3)
                                                                         982428
                                                                         882438
C USE EXPECTED NUMBER OF FAILURES AS THE MEAN OF A POISSON
                                                                         982448
   DISTRIBUTION TO GET THE NUMBER OF FAILURES GENERATED.
                                                                         382458
                                                                         802446
      X = NPSSN(XX(2),2)
                                                                         862476
                                                                         882486
C DETERMINE EXPECTED NUMBER OF FAILURES FOR RETURN SORTIE.
                                                                         382498
                                                                         982596
      XX(2) = X1 + X2 + ATRIB(4)
                                                                         362516
                                                                         362526
   DETERMINE NUMBER OF FAILURES ON RETURN SORTIE AND, ADD
                                                                         $8253$
   TO THE NUMBER OF FAILURES ON THE OUTBOUND SORTIE.
                                                                         982548
                                                                         882558
      X = X + NPSSN(XX(2),2)
                                                                         882568
Ĉ
                                                                         662576
C IF NO FAILURES OCCUR, BOTH MX AND SUPPLY TIMES ARE ZERO.
                                                                         882588
C
                                                                         662596
      IF (X.EQ.#) THEN
                                                                         882688
        ATRIB(3) = 6
                                                                         992619
        ATRIB(4)=8
                                                                         882628
      RETURN
                                                                         66263#
                                                                         582646
      ENDIF
                                                                         882658
C IF FAILURES OCCURRED, DETERMINE TIME TO REPAIR (USING
                                                                         882668
C PARAMETERS: Y1 & Y2: SET PREVIOUSLY). ALL TIMES COME
                                                                         $$2678
C FROM GAMMA DISTRIBUTIONS,
                                                                         882688
                                                                         $62696
      IF (X.GT.#) Y=GAMA(Y1,Y2,3)
                                                                         682766
                                                                         662718
   ADJUST MX TIME IF MORE THAN ONE PART FAILED IN THIS SUBSYSTEM.
                                                                         952725
                                                                         682738
      IF (K.EQ.1) ATRIB(3)=Y
                                                                         882748
      IF (I.EQ.2) ATRIB(3)=1.5+Y
                                                                         #82758
      IF (I.EQ.3) ATRIB(3)=1.75+Y
                                                                         682768
      IF (I.GE.4) ATRIB(3)=2.6+Y
                                                                         952775
                                                                         552786
C DETERMINE SUPPLY DELAY, IF ANY, IN USERF.
                                                                         $$279$
                                                                         882866
      ATRIB(4) = USERF(1)
                                                                         662816
                                                                         ##282#
C IF THERE WILL BE A SUPPLY DELAY. DIVIDE MX TIME IN HALF.
                                                                         $$2836
```

C	SINCE SOME WORK WILL BE DONE BEFORE AND SOME AFTER THE	<b>00</b> 284 <b>6</b>
	SUPPLY DELAY.	3 <b>6</b> 285 <b>0</b>
Ĉ		<b>46</b> 284 <b>6</b>
•	IF (ATRIB(4).GT.9) ATRIB(3)=ATRIB(3)/2	392879
	RETURN	<b>38</b> 288 <b>9</b>
	END	<b>99</b> 289 <b>9</b>

```
FUNCTION USERF(I)
     COMMON/SCOM1/ ATRIB(188).DD(188).DDL(188).DTNOW.11.MFA.MSTCP.NCLNR682928
    1.NCRDR.NPRNT.NNRUM.NNSET.NTAPE.SS(188).SSL(188).TNEXT.TNOW.XX(188)882938
£
     GG TO (1)+I
                                                                   882958
882968
C THIS FUNCTION IS USED TO DETERMINE HOW LONG AN ACFT **
                                                                   882978
C IS DOWN WHILE WAITING FOR SUPPLY. NOTE THAT SUPPLY **
                                                                   882988
                                                   **
C IS NOT A FACTOR FOR THE FIRST 12 DAYS (288 HOURS)
                                                                   $$2998
                                                    ++
C THIS IS DUE TO LOCAL STOCK AND WRSK STOCKPILES.
                                                                   663666
                                                                   883818
883828
C++ FIRST, DETERMINE IF SUPPLY IS A FACTOR ++
                                                                   893938
                                                                   863846
     IF (DRAND(3).LE..75) GO TO 388
                                                                   863656
     IF (TNOW.LE.288) GO TO 355
                                                                   363866
                                                                   663678
£.
C++ FOR THE C141 ++
                                                                   693986
                                                                   383898
                                                                   863168
      IF (ATRIB(2).EQ.2) GO TO 3#
                                                                   363115
     X=DRAND(3)
      IF (X.LE..884) GO TO 381
                                                                   663128
      IF (Y.LE., 33%) GO TO 382
                                                                   663136
                                                                   863146
     GO TO 363
 398 USERF=#
                                                                   663156
                                                                   963165
     RETURN
                                                                   263178
 361 USERF=(6366.#(X)+24.)#1.#
                                                                   283188
     RETURN
                                                                   883196
 362 USERF=(73.62+(X-.684)+48.)+1.6
                                                                   ##32##
     RETURN
                                                                   663216
 383 USERF=(143.28+(1-.338)+72.1+1.8
                                                                   ##322#
     RETURN
                                                                   883238
C++ FOR THE C5 ++
                                                                   983246
                                                                   883258
                                                                   $83266
    X=DRAND(3)
     IF (X.LE..##2) GO TO 3#4
                                                                   983278
     IF (K.LE..233) GO TO 3#5
                                                                   683286
     IF (I.LE..323) GO TO 386
                                                                   663296
                                                                   663366
     IF (X.LE..338) GO TO 387
     IF (I.LE..585) CO TO 398
                                                                   663316
     GO TO 359
                                                                   883328
 364 USERF=(12666,+(1)+24,)+1.6
                                                                   963336
     RETURN
                                                                   863348
 365 USERF=(163.9+(1-.662)+48.)+1.8
                                                                   663356
                                                                   ##336#
     RETURN
 386 USERF=(266.67+(X-.233)+72.1+1.6
                                                                   ##337#
                                                                   ##338#
     RETURN
 367 USERF=(1666.+(X-.323)+96.)+1.6
                                                                   683396
                                                                   683456
     RETURN
```

THE PARTY OF THE

388 USERF=(97.17+(X-,338)+128.1+1.2 883418
RETURN 883428
RETURN 983436
RETURN 983448
END 883458

```
663486
                                                                              883498
   MAINTENANCE MODEL NETWORK
                                                                              2635##
                                                                              993519
GEN.STANBERRY. MX MODEL, 12/15/1981;
                                                                              883528
LIM, 21, 5, 45661
                                                                              ##353#
NETWORK:
                                                                              393549
                               FLT. CONTROLS MX PERS
      RES/M431R2(74):11
                                                                              $8355$
                               LANDING GEAR MY PERS
       RES/M431W2(18),21
                                                                              883588
                                ELECTRICAL SYSTEMS MX PERS
       RES/M423X#(43):31
                                                                              193575
                                PNEUDRAULICS MX PERS
       RES/M423X4(57),4;
                                                                              $$358$
                                ENGINE MX PERS
       RES/M426X2(193),5;
                                                                              883598
                                ENVIRONMENTAL SYSTEMS MX PERS
       RES/M423X1 (46) 161
                                                                              883688
                                FUEL SYSTEMS MX PERS
       RES/M42313(28),71
                                                                              863619
                                INSTRUMENTS MX PERS
       RES/M325X1(45) 181
                                                                              28362
                                AUTOPILOT MX PERS
       RES/M32518(37) .91
                                                                               923639
                                NAVIGATION SYSTEMS MX FERS
       RES/M328X1 (49) . 187
                                                                               993649
                                INS & RADAR MY PERS
       RES/M328X4(36),111
                                                                               993659
       CRE..2.8.6,1,1866,1;
                                                                               68366
       ASS:XX(1)=XX(1)+1:
                                                                               893679
           ATRIB(3) = RNORM(7.7,.2),
                                                                               983688
           ATRIB(4)=RNORM(9.3,.2);
                                                                               963696
       ACT.,XX(1).LE.3:AS1;
                                                                               883788
       ACT,, XX(1), EQ. 4;
                                                                               663716
       ASS,ATRIB(2)=2, XX(1)=6;
                                                                               983729
        ACT .. , G01;
                                                                               663735
       ASS,ATRIB(2)=1;
 AS1
                                                                               883748
       G00N-1#1
 CB1
                                                                               683756
        ACT ... EVI;
                                                                               ##37£#
        ACT,,,EV2;
                                                                               48377#
        ACT ... EV3
                                                                               663786
        ACT .. . EV4;
                                                                               663796
        ACT ... EV5;
                                                                                ##38##
        ACT ... EV6;
                                                                                $$381$
        ACT ... EV7:
                                                                                ##382#
        ACT.,,EV8;
                                                                                863835
        ACT ... EV91
                                                                                443844
        ACT ... EVIST
                                                                                ##385#
  EVI EVE. 1.11
                                                                                118811
        ACT . ATRIB(3) .EQ. 8.Q11
                                                                                553875
        ACT., ATRIB(2) .EQ. 1, GO2;
                                                                                $$388$
        ACT , , ATRIB(2) .EQ. 2, CO3;
                                                                                ##389#
        COON, 1;
                                                                                #63966
        ACT.ATRIB(3)..613.GOZZ;
                                                                                883915
         ACT ... 383 .AN11
                                                                                563925
         ACT . . . #84 . AN4 ?
                                                                                ##393#
  G03 G00M:17
                                                                                143944
         ACT.ATRIB(3)..453.6022;
                                                                                563956
         ACT . . . 264 , AN1 ;
                                                                                863965
         ACT. . #51, ANS;
                                                                                ##3979
         ACT .. . 232 . AN4 ;
```

EV2 EVE.2.1;     ACTATRIB(3).EB.8.Q2;     ACTATRIB(2).EQ.1.GO4;     ACTATRIB(2).EQ.2.GO5;  GO4 GOON.1;     ACTATRIB(3)88.GO22;     ACT145.AW3;     ACT145.AW3;     ACT382.AW4;  GO5 GOON.1;     ACT472.AW2;     ACT472.AW2;     ACT281.AW4;     ACT281.AW4;     ACTATRIB(3).EQ.8.Q3;     ACTATRIB(2).EQ.1.GO6;     ACTATRIB(2).EQ.2.GO7;  GO6 GOON.1;     ACTATRIB(3)189.GO22;  ACT254.AW1;	283788 383798 324288 294812 284823 384828 884238 88488 88488 88488 88488 88488 884188 884128 884128 884128
ACTATRIB(2).EQ.2.GO5;  GO4 GOON:1;  ACT.ATRIB(3)88.GO22;  ACT473.AW3;  ACT145.AW3;  ACT382.AW4;  GO5 GOON:1;  ACT847.AW1;  ACT472.AW2;  ACT472.AW2;  ACT472.AW3;  ACT281.AW4;  ACT281.AW4;  ACT281.AW4;  ACT874.AW3;  ACT874.AW3;  EV3 EVE.3:1;  ACTATRIB(3).EQ.8.Q3;  ACTATRIB(2).EQ.1.GO6;  ACTATRIB(2).EQ.2.CO7;  GO6 GOON:1;  ACT.ATRIB(3)189.GO22;	324888 994818 884928 384838 384838 884358 884868 884878 884888 884188 884128 884123 884138
ACT. ATRIB(2) .EQ.2,605;  GO4 GOON: i;  ACT. ATRIB(3)88.GO22;  ACT473,AM3;  ACT145,AM3;  ACT382,AM4;  GO5 GOON: i;  ACT847,AM1;  ACT472,AM2;  ACT472,AM2;  ACT281,AM4;  ACT281,AW4;  ACT281,AW4;  ACT47RIB(3)28.\$Q3;  ACT47RIB(3)29.\$Q3;  ACT47RIB(3)29.\$Q3;  ACT47RIB(2) .EQ.3,Q3;  ACT4TRIB(2) .EQ.2,CO7;  GO6 GOON: i;  ACT. ATRIB(3)189,GO22;	994818 984928 384848 984358 984868 984878 984898 984188 984123 984123 984148
GO4 GOON:1;     ACT:ATRIB(3)88.GO22;     ACT:473.AM2;     ACT:145.AM3;     ACT:382.AM4;  GO5 GOON:1;     ACT:847.AM1;     ACT:472.AM2;     ACT:472.AM2;     ACT:281.AM4;     ACT:281.AM4;     ACT:281.AM4;     ACT:874.AM8;  EV3 EVE.3:1;     ACT:ATRIB(3)EQ8.Q3;     ACT:ATRIB(2)EQ1.GO6;     ACT:.ATRIB(2)EQ2.CO7;  GO6 GOON:1;     ACT:.ATRIB(3)189.GO22;	964929 364848 984358 984878 984878 984378 984388 984188 984138 984123 984148
ACT.ATRIB(3). #8.GO22; ACT473.AM2; ACT145.AM3; ACT382.AM4; GO5 GOON:1; ACT847.AM1; ACT472.AM2; ACT472.AM2; ACT281.AM4; ACT281.AM4; ACT281.AM4; ACT874.AM8; EV3 EVE.3.1; ACT4TRIB(3).EQ.8.Q3; ACTATRIB(2).EQ.1.GO6; ACTATRIB(2).EQ.2.CO7; GO6 GOON.1; ACT.ATRIB(3)189.GO22;	284838 384848 884258 884868 884878 884878 884188 884123 884123 884138
ACT++.473.AN2; ACT++.145.AN3; ACT++.382.AN4; GOS GOON:1; ACT+ATRIB(3)128.GO22; ACT+847.AN1; ACT+472.AN2; ACT+478.AN3; ACT+281.AN4; ACT++.281.AN4; ACT++.281.AN4; ACT++.281.AN4; ACT++.47RIB(3).EQ.8.Q3; ACT++ATRIB(2).EQ.1.GO6; ACT+.ATRIB(2).EQ.2.CO7; GO6 GOON:1; ACT+ATRIB(3)189.GO22;	364848 884568 884868 884878 884888 884888 884188 884123 884123 884148
ACT+.145,AN3; ACT+.382,AN4;  GOS GOON:1; ACT-ATRIB(3).128,GO22; ACT847,AN1; ACT+.472,AN2; ACT+.278,AN3; ACT+.281,AN4; ACT+.281,AN4; ACT+.474,AN8;  EV3 EVE,3:1; ACT+.4TRIB(3).EQ.8.Q3; ACT+.4TRIB(2).EQ.1,GO6; ACT+.ATRIB(2).EQ.2,GO7;  GO6 GOON:1; ACT-ATRIB(3).189,GO22;	884058 884868 884878 884808 884808 984188 884118 884123 884138
ACT::382;AN4;  GD5 GD0N:1; ACT:ATRIB(3):.128;GD22; ACT::.947;AN1; ACT::.472;AN2; ACT::.278;AN3; ACT::.281;AN4; ACT::.874;AN8;  EV3 EVE:3:1; ACT::ATRIB(3):EQ.8;Q3; ACT::ATRIB(2):EQ.1;GO6; ACT::ATRIB(2):EQ.2;GO7; GD6 GOON:1; ACT:ATRIB(3):.189;GO22;	884868 884878 884878 884878 884118 884123 884123
GOS GOON:1;  ACT:ATRIB(3):.128:GO22;  ACT:947:AN1;  ACT:472:AN2;  ACT:281:AN4;  ACT:281:AN4;  ACT:874:AN8;  EV3 EVE.3:1;  ACT:.ATRIB(3).EQ.8:Q3;  ACT:.ATRIB(2).EQ.1:GO6;  ACT:.ATRIB(2).EQ.2:GO7;  GO6 GOON:1;  ACT:ATRIB(3):.189:GO22;	864878 864888 884898 864188 884123 884123 884138
ACT: ATRIB(3): 128: G022; ACT: .847: AN1; ACT: .472: AN2; ACT: .472: AN3; ACT: .281: AN4; ACT: .874: AN8; EV3 EVE: 3:1; ACT: .4TRIB(3): EQ.8: Q3; ACT: .4TRIB(2): EQ.1: G06; ACT: .4TRIB(2): EQ.2: G07; G06 G00N: 1; ACT: ATRIB(3): .189: G022;	964888 884898 864188 884123 884123 884138
ACT,847, AW1; ACT,472, AW2; ACT,278, AW3; ACT,281, AW4; ACT,874, AW8; EV3 EVE, 3,1; ACT,ATRIB(3).EQ.8,Q3; ACT,ATRIB(2).EQ.1,GO6; ACT,ATRIB(2).EQ.2,CO7; GO6 COON,1; ACT, ATRIB(3),.189,GO22;	284979 864188 864118 884123 884138 884148
ACT::.472; AN2; ACT::.578; AN3; ACT::.251; AN4; ACT::.574; AN8; EV3 EVE:3:1; ACT::ATRIB(3).EQ.5:Q3; ACT::ATRIB(2).EQ.1; GO6; ACT::ATRIB(2).EQ.2; GO7; GO6 GOON;; ACT::ATRIB(3):.189; GO22;	964186 864119 884123 884138
ACT,:.978;AW3; ACT,:.281;AW4; ACT,:.974;AW8; EV3 EVE,3;1; ACT,:ATRIB(3).EQ.8;Q3; ACT,:ATRIB(2).EQ.1;G06; ACT,:ATRIB(2).EQ.2;G07; G06 G00N;1; ACT,ATRIB(3),.189;G022;	864118 884123 884138 884148
ACT,2#1,AW4; ACT,#74,AW8; EV3 EVE,3:1; ACT,.ATRIB(3).EQ.#.Q3; ACT,.ATRIB(2).EQ.1,GO6; ACT,.ATRIB(2).EQ.2,GO7; GO6 GOON,1; ACT,ATRIB(3)189,GO22;	884128 884138 884148
ACT\$74.AW8; EV3 EVE.3:1; ACTATRIB(3).EQ.\$.Q3; ACTATRIB(2).EQ.1.GO6; ACTATRIB(2).EQ.2.GO7; GO6 GOON.1; ACT.ATRIB(3).189.GO22;	884138 984148
EV3 EVE,3:1; ACT,:ATRIB(3).EQ.#:Q3; ACT::ATRIB(2).EQ.1:G06; ACT::ATRIB(2).EQ.2:G07; G06 G00N:1; ACT:ATRIB(3):.189:G022;	984149
EV3 EVE,3,1;     ACT,,ATRIB(3).EQ.\$,Q3;     ACT,,ATRIB(2).EQ.1,G06;     ACT,,ATRIB(2).EQ.2,CO7; G06 G00N;1;     ACT,ATRIB(3),.189,G022;	
ACT, ATRIB(3).EQ.8,Q3; ACT, ATRIB(2).EQ.1,G06; ACT, ATRIB(2).EQ.2,G07; GO6 GOON;1; ACT, ATRIB(3),.189,G022;	484154
ACT, ATRIB(2).EQ.1,GO&; ACT, ATRIB(2).EQ.2,GOT; GO& GOON,1; ACT, ATRIB(3),.189,GO22;	44.10
ACT, ATRIB(2).E9.2,C07; COA COON,1; ACT, ATRIB(3),.189,C022;	094169
G06 G00N,1; ACT,ATRIB(3),.189,G022;	884173
ACT, ATRIB(3), .189, GO22;	254182
	354195
	884288
ACT.,.165,AW3)	694216
ACT,,,228,AW4;	384228
ACT, , . 156, ANS;	664236
ACT,,.868,AN9;	884248
GO7 GOON,1;	884258
ACT, ATRIB(3), .217, G022;	884268
ACT++.163+AW1;	994279
ACT127,AW3;	994288
ACT , , , 493 , AN4 ;	884296
EV4 EVE.4-1:	884388
ACT, ATRIB(3), EQ. \$, Q4;	864318
ACT., ATRIB(2).EQ.1,G08;	554325
ACT+, ATRIB(2) .EQ. 2, G09;	994339
COS COON, 1;	884346
ACT, ATRIB(3), .177, G022;	\$\$435 <b>\$</b>
ACT.,,434,AM5;	694366
ACT389,AN8;	664376
CO9 COON:11	664386
ACT+ATRIB(3)+.257+G022;	<b>66</b> 43 <b>96</b>
ACT++.413+AN5;	884496
ACT338.AU8;	<b>884418</b>
EV5 EVE.5:1;	994428
ACT.,ATRIB(3),EQ.6,Q5;	<b>55</b> 443 <b>5</b>
ACT, ATRIB(2).EQ.1,G01#	884448
ACT.,ATRIB(2).ED.2,G011;	884458
CO1# COON,1;	664466
ACT, ATRIB(3), .113, G022;	

	ACT++.078+AW1;	<b>3844</b> 88
	ACT++.787+AW3+	324492
	ACT	\$845 <b>\$</b> 9
	ACT+1.#51+AW9+	994516
G311	***************************************	994529
	ACT+ATRIB(3)+.295,G022;	994532
	ACT++.576+AW3;	984549
	ACT++.189+AW51	89455 <b>6</b>
EV6		9645A9
	ACT::ATRIB(3).EQ.8.Q6;	984578
	ACT::ATRIB(2).EQ.1;GO12;	<b>49458</b>
	ACT, ATRIB(2).EQ.2,GB13;	984599
G012	***************************************	994589
	ACT+ATRIB(3)+.023+G0221	964519
	ACT++.912+AW4;	994629
	ACT::.#65:AW8;	864638
G013	G00N+11	994649
	ACT, ATRIB(3), . #82, GO22;	964656
	ACT++.72#+AW4;	884568
	ACT++.146+AU6;	884678
	ACT++.#52+AW8;	564658
EV7	EVE,7,1;	934698
	ACT, (ATRIB(3).EQ.\$,Q7;	894729
	ACT, (ATRIB(2),EQ.1,GD14)	894719
	ACT , :ATRIB(2).EQ.2,G015;	884723
G014	GOON: 13	884738
	ACT.ATRIB(3)#A8.GD22;	884718
	ACT::.548:AU7:	894758
	ACT, 392, AW8;	98476 <b>8</b>
GD15	G00N+1;	384773
	ACT, ATRIB(3), . 697, CD22;	994789
	ACT++.416+AW3;	gg:79g
	ACT 289 . AW7 ;	3848 <b>66</b>
	ACT.1.278:AW8;	364816
EV8	EVE, 8,1;	654826
	ACT, ATRIB(3),EQ.#,Q8;	984838
	ACT, :ATRIB(2).EQ.1,G016;	\$8484 <b>8</b>
	ACT + ATRIB(2) .EQ.2,G017;	\$4859
C016	GOON:13	994868 984868
****	ACT, ATRIB(3), .868, C022;	
	ACT.,.992,AW8;	\$\$487 <b>\$</b> \$\$488\$
G017	G00N:1;	
***	ACT, ATRIB(3), . #77, c022;	88489 <b>8</b> 884898
	ACT	##47PP ##491#
	ACT, 277, AU9;	\$\$492\$
	ACT 118 - AN18 :	\$\$472\$ \$\$493\$
EV9	EVE,9.1;	964946
	ACT, (ATRIB(3), ED. #, Q9;	\$\$495\$
	ACT - ATRIB(2) .EQ.1-G018;	984769 984969
	ACT,,ATRIB(2).EQ.2,G019;	884978
	nantumintariet spadfilanett	204412

		284988
6018	G00N:13	284998
	ACT, ATRIB(3), .008, G022;	205726
	ACT++.992+AN10;	895018
G019		69592 <b>6</b>
	ACT,ATRIB(3),.#12,G022;	997925
	ACT,:,588,AW10;	*****
	ACT+1.498+AW11F	865846
EV18	EVE+1#+1;	\$\$5\$5\$ \$\$5\$1\$
	ACT, (ATRIB(3).EQ.8,Q18)	995340
	ACT, ATRIB(2).EQ.1,GO2#;	995978
	ACT., ATRIB(2) .EQ.2, GO217	995989
C02#	COON: 1;	665698
	ACT, ATRIB(3), .##2, G022;	965186
	ACT++.567+AW1#F	995116
	ACT,,,431,AW11;	665126
G021		985138
	ACT, ATRIE(3), . \$42, G022;	585149
	ACT., . #86.AN5;	995159
	ACT.,.872,AW11;	885168
AUI	AWA(1),M431R2/1+1;	995179
1144.5	ACT, ATRIB(3);	305103
	FRE, M431R2/1,1;	<b>66</b> 519 <b>8</b>
	ACT ., ATRIB(4) .EQ. 8, G022;	995299
	ACT, ATRIB(4), ATRIB(4).GT.8;	925219
	ASS,ATRIB(4)=8;	99522 <b>9</b>
	ACTANII	<b>695236</b>
AW2	ANA (2) : H431H2/1:17	865246
UME	ACT, ATRIB(3);	3 <b>9</b> 525 <b>9</b>
	FRE-M431W2/1-1;	885266
	ACT, ATRIB(4) .EQ. #.GO22;	695276
	ACT, ATRIB(4), ATRIB(4).GT.8;	995286
	ASS,ATRIB(4)=#;	665296
	ACT+++AW2+	995369
AM3	ANA (3) -M423X8/1-17	995318
1180	ACT, ATRIB(3);	665329
	FRE,M423X0/1,11	<b>665</b> 33 <b>6</b>
	ACT, ATRIB(4) .EQ. 8, GO22;	805348
	ACT, ATRIB(4), ATRIB(4).GT. #	995359
	ASS+ATRIB(4)=6;	\$\$53 <b>6</b> \$
	ACT,,,AN3;	<b>685376</b>
ANA		<b>66</b> 538 <b>9</b>
11411	ACT, ATRIB(3);	865398
	FRE, M423X4/1,1;	<b>\$\$</b> 54 <b>\$\$</b>
	ACT, ATRIB(4) .EQ. \$, G022;	985415
	ACT, ATRIB(4), ATRIB(4).GT.#i	\$65428
	ASS.ATRIB(4)=#;	\$65438
	ACT.,,AU4i	\$6544\$
ANS		<b>\$85</b> 458
1483	ACT,ATRIB(3);	995469
	FRE, M426 X2/1, 1;	<b>\$\$</b> 547 <b>\$</b>
	LUPLILIZEANDL 91 91	

---

	ACT: rATRIB(4).E3.8:G022;	105400
	ACT+ATRIB(4)+ATRIB(4).GT.ØI	88549 <b>6</b>
	ASS,ATRID(4)=0;	995599
	ACT+++AWSF	365518
486	ANA (6) +M423X1/1+17	995529
	ACT+ATRIB(3);	39553 <b>\$</b>
	FRE,M423X1/1,11	885540
	ACT+:ATRIB(4).EQ.#+G022;	995559
	ACT, ATRIB(4), ATRIB(4).GT.B;	865588
	ASS.ATRIB(4)=8;	365573
	ACT+++AW6F	<b>29</b> 559 <b>2</b>
A¥7	AWA(7)+#423X3/1+19	285598
	ACT, ATRIB(3);	6 <b>8</b> 566 <b>9</b>
	FRE, M423X3/1,11	365616
	ACT: ATRIB(4) .EQ.8.G022;	005520
	ACT, ATRIB(4), ATRIB(4), CT. 9;	885638
	ASS, ATRIB(4) = 9;	082948
	ACT, 1, AN7;	885658
AUS	ANA (8) -M325X1/1-1	995669
	ACT (ATRIB(3))	<b>33</b> 567 <b>3</b>
	FRE+#325X1/1+1;	935189
	ACT, ATRIB(4).EQ.9,G022;	995699
	ACT, ATRIB(4), ATRIB(4), CT. 3;	995789
	ASS, ATRIB(4) = 0;	885718
	ACT, , ANS;	995729
AU9	ANA(9),M325XØ/1:1;	365736
	ACT+ATRIB(3);	8857±0
	FRE, M325X8/1,11	895759
	ACT: ATRIB(4).EQ.#+G022;	885748
	ACT.ATRIB(4).ATRIB(4).GT.Ø;	865773
	ASS+ATRIE(4)=0;	395783
	ACT:::AW9;	##579#
4418	AUA(16),M328X1/1,17	69583 <b>8</b>
	ACT:ATRIB(3);	<b>99</b> 581 <b>9</b>
	FRE, M328X1/1,1;	665825
	act, Atrib(4).Eq.#.G022;	##583#
	ACT, ATRIB(4), ATRIB(4).CT.#;	885848
	ASS,ATRIB(4)=6;	695858
	ACT: : AN16;	##58 <b>6</b> #
AU11	ANA(11), M328X4/1,1;	665878
	ACT, ATRIB(3);	665886
	FRE, M328X4/1,1;	365896
	ACT, ATRIB(4).EQ.#,G022;	885968
	ACT, ATRIB(4), ATRIB(4).CT.6;	945919
	ASS,ATRIB(4)=#;	##592#
	ACT, , AVII;	665938
G022	G00N, 1;	865946
	ACT,ATRIB(3)+ATRIB(4),ATRIB(4).GT.8,G023;	<b>#65950</b>
	ACT, ATRIB(4).EQ.4,G023;	\$65966
C023	COON+1;	865978

```
225938
      ACT++ATRIB(5).EQ.1+Q1;
      ACT++ATRIB(5) .EQ.2+Q2;
                                                                              285776
                                                                              886663
      ACT .. ATRIB (5) . EQ. 3:93;
                                                                              336818
      ACT .. ATRIB(5) .EQ. 4.64;
      ACT .. ATRIB (5) .EQ.5.95;
                                                                              286222
                                                                              884838
      ACT + ATRIB(5) .EQ.6+Q6;
                                                                              386848
      ACT++ATRIB(5) .EQ.7+Q7;
      ACT .. ATRIB(5) .EQ.8,Q8;
                                                                              88685#
      ACT .. ATRIB(5) .EQ.9.99;
                                                                              28484B
      ACT .. ATRIB(5) .EQ. 15.015;
                                                                              996379
                                                                              88688
      QUE(12) ... HATCI
                                                                              286298
92
      QUE(13) .... MATCE
                                                                              886188
93
      QUE (14) ....MATCI
      QUE(15) ... MATC:
                                                                              366:16
94
45
      QUE(16) .... MATC:
                                                                              386128
      QUE(17) .... MATC!
                                                                              286138
Q6
                                                                              666146
97
      QUE(18) .... MATCI
      QUE(19),,,,MATCI
                                                                              666156
89
      QUE (28) .... MATCI
                                                                              66166
99
                                                                              886176
218
      QUE(21) ... MATCI
                                                                              886188
MATC
      MAT+1+Q1/A1+Q2/A1+Q3/A1+Q4/A1+Q5/A1+Q6/A1+Q7/A1+Q8/A1+
                                                                              #8619#
      Q9/A1:Q19/A1;
                                                                              896298
      ACCUM, 18, 18, HIGH (3), 1;
                                                                              986216
      COL. INT(1). TOT TIME;
                                                                              986229
      TERM
                                                                              986238
      END;
                                                                              886248
INIT. #
                                                                              886258
FINE
```

Appendix B
Simulation Model

```
WFS, CM285888, T858, T0158. T818872, STANBERRY, S0X4577
                                                                                       388188
ATTACH, PRODEIL, SLAMPROC, ID=AFIT.
FTN5, ANSI=0.
                                                                                       3381:2
                                                                                       203:23
BEGIN, SLAM, , N=LSS, PL=18883.
                                                                                       909:33
                                                                                       338140
                                                                                       000150
                                                                                       823169
٤
                                                                                       388179
      PROGRAM MAIN (INPUT, DUTPUT, TAPES=INPUT, TAPE6=OUTPUT, TAPE7)
                                                                                       000:33
      DIMENSION NSET (66288)
                                                                                       928198
       COMMON/SCOM1/ ATRIB(188): DD(188): DDL(188): CTNOW: II: MFA: MSTOP: NCLNR
                                                                                       233298
      1.NCRER, NPRNT, KNRCH, NNSET, KTAPE, 35 (100), SSL (100), TNEXT, THOW, XX (100)
                                                                                       369213
      COMMON OSET (80000)
                                                                                       300113
      EQUIVALENCE (NSET(1), GSET(1))
                                                                                       826238
      NNSET=60000
                                                                                       888246
      NCRDR=5
                                                                                       300252
      NPRNT=6
                                                                                       300263
      NTAFE=7
                                                                                       060270
      CALL SLAM
                                                                                       382288
      STOP
                                                                                       000290
      END
                                                                                       939369
```

```
272324
102332
                 EUSROLTINE EVENT (I)
               CCMMIN/SCOMI/ ATRIB(1880) (20(188) (881) (881) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (870) (
                                                                                                                                                                                                                                          3921 2
                 COMMON/EVENTA/CTB:/SUTE:/FLYNE/FLYT5/TD:/FODAY/
                                                                                                                                                                                                                                         322353
               *TONNS: TONTS: JTES: CTD: CTDS: CUTES: FLYN1: FLYTL:
                                                                                                                                                                                                                                         300 300
              *TE, TES, TONNI, TONTI, GTE1
                                                                                                                                                                                                                                         239378
                 GO TO (1,2,3,4,5,6,7,3,7,10,11),1
                                                                                                                                                                                                                                         233383
                                                                                                                                                                                                                                         303198
 C EVENT 1: SETS PARAMETERS FOR W.U.C. # 11
                                                                                                                                                                                                                                          363423
                                                                                                                                                                                                                                          203419
C 44 FOR 4 C-141 44
                                                                                                                                                                                                                                          253422
                                                                                                                                                                                                                                          322-38
                 ATRI3(5)=1
                                                                                                                                                                                                                                         362443
                 IF(ATRIB(2).EQ.2) GO TO 118
                                                                                                                                                                                                                                         308473
                 X1=.#336
                                                                                                                                                                                                                                         293468
                 X2=.2434
                                                                                                                                                                                                                                          235473
                 Y1=.9954
                                                                                                                                                                                                                                          363489
                 Y2=3.3421
                                                                                                                                                                                                                                         404492
                 GG TO 130
                                                                                                                                                                                                                                          228526
                                                                                                                                                                                                                                         2005.0
0 ## FOR A 0-5 ##
                                                                                                                                                                                                                                          386514
                                                                                                                                                                                                                                         233503
                                                                                                                                                                                                                                         882543
   113 X1=.373
                                                                                                                                                                                                                                         000553
                 12=.2:2
                  11=3.3737
                                                                                                                                                                                                                                         600563
                 12=.9844
                                                                                                                                                                                                                                          383578
                 GO TO 163
                                                                                                                                                                                                                                         386586
                                                                                                                                                                                                                                         363598
 C EVENT 2: SETS PARAMETERS FOR W.U.C. # 13.
                                                                                                                                                                                                                                         233c 38
                                                                                                                                                                                                                                         3006:3
      ++ FOR A C-141 ++
                                                                                                                                                                                                                                         606528
                                                                                                                                                                                                                                         888638
                 ATRIB(5) = 2
                                                                                                                                                                                                                                         397543
                 IF(ATRIB(2).EQ.2) GO TO 12#
                                                                                                                                                                                                                                         200653
                 X1=.Ø317
                                                                                                                                                                                                                                         882658
                 X2=.0508
                                                                                                                                                                                                                                         009679
                  Y1=.9815
                                                                                                                                                                                                                                          86668£
                  Y2=1.9368
                                                                                                                                                                                                                                          688696
                  GO TO 125
                                                                                                                                                                                                                                          900793
                                                                                                                                                                                                                                          808718
C ** FOR A C-5 **
                                                                                                                                                                                                                                         999726
                                                                                                                                                                                                                                         300730
   128 X1=.614
                                                                                                                                                                                                                                         883743
                 X2=.935
                                                                                                                                                                                                                                         94975#
                 Y1=1.2269
                                                                                                                                                                                                                                         889748
                 Y2=1.4698
                                                                                                                                                                                                                                         833776
                 GO TO 166
                                                                                                                                                                                                                                         996786
                                                                                                                                                                                                                                          360796
                                                                                                                                                                                                                                          466844
 C EVENT 3: SETS PARAMETERS FOR W.U.C. # 14.
                                                                                                                                                                                                                                         1008:3
```

```
0 ++ FOR A 0-141 ++
                                                                                353613
                                                                                333213
     473[3(5)=]
                                                                                300:43
      IF:ATRIB(21.83.2) 66 TI 128
                                                                                323358
     A1=.3129
                                                                                888668
      X2=.3278
                                                                                503878
      Y1=1.3925
                                                                                322223
      12=2.1242
                                                                                327898
      GO TO 138
                                                                                862790
                                                                                3699.3
0 44 FOR A 0-5 44
                                                                                333023
                                                                                234:22
118 X1=,874
                                                                                338:43
      X2=.318
                                                                                223953
      ¥1=..7996
                                                                                338763
      Y2=1.5665
                                                                                333978
     GO TO 100
                                                                                334983
                                                                                303994
  EVENT 4: SETS PARAMETERS FOR W.U.C. # 23.
                                                                                38:399
                                                                                20:3:2
C 44 FOR A C-141 44
                                                                                88:303
                                                                                381433
     ATRIB(5)=4
                                                                                88.348
      IF(ATRIB(2).EQ.2) GO TO 140
                                                                                29:350
      X1=.8524
                                                                                361363
      X2=.0772
                                                                                331379
      Y1=.7625
                                                                                881853
      Y2=3.9844
                                                                                88:398
      GO TO 199
                                                                                30:.39
                                                                                3611:0
  ## FOR 4 C-5 ##
                                                                                331123
                                                                                901139
                                                                                201140
 148 X1=.253
      X2=.896
                                                                                881156
      Y1=1.1153
                                                                                391:43
      Y2=1.6712
                                                                                631178
      GO TO 189
                                                                                261198
                                                                                931199
C EVENT 5: SETS PARAMETERS FOR W.U.C. # 42.
                                                                                891298
                                                                                881218
C ** FOR A C-141 **
                                                                                991229
                                                                                661236
C
     ATRIB(5)=5
                                                                                981249
      IF(ATRIB(2).EQ.2) GO TO 15#
                                                                                661256
      X1=.6665
                                                                                881266
      X2=.9976
                                                                                001276
      Y1=1.1171
                                                                                661286
      Y2=1.2157
                                                                                001290
      CO TO 156
                                                                                461396
C
                                                                                991316
```

The state of the s

```
0 44 703 4 0-5 44
                                                                        33:320
                                                                        J2...2
153 (1:.119
                                                                        98:348
                                                                        20:353
     X2=.838
     11=.8874
                                                                        321363
     12=2.6955
                                                                        781379
     00 TO 133
                                                                        321113
                                                                        391173
€ EVENT 5: SETS PARAMETERS FOR W.U.C. # 45.
                                                                        381463
                                                                        981417
0 ++ FOR A C-141 ++
                                                                        88:420
                                                                        281438
     4TRIB(5)=6
                                                                        33:443
      IF(ATRIE(2).EQ.2) GO TO 169
                                                                        391459
     X1=.2097
                                                                       38:443
     X2=.8292
                                                                        39:473
     Y1=.4326
                                                                        201489
      Y2=4.3923
                                                                        361498
     GO TO 188
                                                                        88.589
                                                                        001510
C ## FOR A C-5 ##
                                                                        861523
                                                                        991530
168 X1=.151
                                                                       881548
     (2=.243
                                                                        201550
     Y1=.5574
                                                                        90:569
     12=3.66#2
                                                                        33:570
     GO TO 139
                                                                        34.559
                                                                        2015-2
C EVENT 7: SETS PARAMETERS FOR W.U.C. # 46.
                                                                        221688
                                                                        881618
C 49 FOR A C-141 44
                                                                        00:520
                                                                        861638
     ATRIB(5)=7
                                                                        361443
      IF(ATRIB(2).EQ.2) GO TO 178
                                                                        661656
     X1=.312
                                                                        331568
     X2=.338
                                                                        99:679
     Y1=1.376
                                                                        291669
     Y2=2.8644
                                                                        36:696
     CO TO 139
                                                                        221700
                                                                        991719
C ** FOR A C-5 **
                                                                        991729
                                                                        661736
178 X1=.111
                                                                        881746
                                                                        881756
      X2=.012
      Y1=.5229
                                                                        991769
     Y2=3.5153
                                                                        891773
     CO TO 166
                                                                        361788
                                                                        961794
C EVENT 8: SETS PARAMETERS FOR W.U.C. # 51.
                                                                        661866
                                                                        001810
```

```
0 ++ FOR A 1-141 ++
                                                                        30:113
                                                                        J3186J
      47RIB(5.=8
                                                                        å€ ::4g
      IF(47913(2),EQ.2) GG TG 188
                                                                        991359
      11:.2218
                                                                        231969
      XI=.0181
                                                                        33:373
      11=.1238
                                                                        891338
      ¥2=9.931
                                                                        331596
      GO TO 199
                                                                        801933
                                                                        391913
0 44 FOR A 0-5 44
                                                                        201922
                                                                        381938
198 X1=.100
                                                                        331943
      X2=.849
                                                                        201950
      Y1=.1225
                                                                        881968
     Y2=13.9255
                                                                        381 173
     GO TO 199
                                                                        361986
                                                                        301992
C EVENT 9: SETS PARAMETERS FOR W.U.C. # 72.
                                                                        202223
                                                                        202310
C ** FOR A C-14: **
                                                                        552329
                                                                        202003
     ATRIB(5)=9
                                                                        382946
      IF(ATRIB(2).E1.2) SG TO 196
                                                                        392359
      X1=.3709
                                                                        882868
     X2=.8266
                                                                        002978
     Y1=.8439
                                                                        882888
     Y2=29.5124
                                                                        382898
     GC 70 100
                                                                        002100
                                                                        862118
0 ## FOR A C-5 ##
                                                                        332120
                                                                        882138
19# X1=.262
                                                                        392146
      12=.885
                                                                        082156
      Y1=.3622
                                                                        392169
     Y2=4.8696
                                                                        302:70
     GO TO 189
                                                                        882188
                                                                        392198
C EVENT 18: SETS PARAMETERS FOR W.U.C. # 55 & # 73.
                                                                        982296
                                                                        982219
C ** FOR A C-141 **
                                                                        992229
                                                                        002230
 16
    ATRIB(5)=16
                                                                        802248
      IF(ATRIB(2).EQ.2) GO TO 200
                                                                        362258
      X1=.#138
                                                                        982268
      X2=.6126
                                                                        862276
      Y1=.1114
                                                                        002230
      Y2=12.5641
                                                                        892298
      GO TO 199
                                                                        882386
C
                                                                        992319
```

```
392323
302323
392343
  ** FOR A 0-5 **
 138 | 31=,113
                                                                         331353
      X2=.563
      71=.27@7
                                                                         202343
      32=7,2738
                                                                         202373
                                                                         ##238#
                                                                         302393
0 ADDRESS 100: FIRST/DETERMINES EXPECTED NUMBER OF FAILURES
                                                                         202488
C FIR THE APPROPRIATE WORK UNIT CODE (USING THE PARAMETERS.
                                                                         332418
C X1 AND X2, SET ADOVE), FOR THE OUTBOUND SORTIE.
                                                                         302423
                                                                         7,72433
 138 XX(13) = X1 + X2 + ATRIB(4)
                                                                         322444
                                                                         302453
C. USE EXPECTED NUMBER OF FAILURES AS THE MEAN OF A POISSON
C DISTRIBUTION TO GET THE NUMBER OF FAILURES GENERATED.
                                                                         202473
                                                                         882588
     X = NPSSN(XX(10),2)
                                                                         302490
  DETERMINE EXPECTED NUMBER OF FAILURES FOR RETURN SURTIE.
                                                                         392513
                                                                         362523
      XX(1Ø) = X1 + X2 + ATRIB(6)
                                                                         3015-0
  DETERMINE NUMBER OF FAILURES ON RETURN SCRITE AND ADD
                                                                        382558
  TO THE NUMBER OF FAILURES ON THE OUTBOUND SORTIE.
                                                                        892568
                                                                        332578
      X = X + MPSSN(XX(10),2)
                                                                        302530
                                                                        882508
  IF NO FAILURES OCCUR, BOTH MX AND SUPPLY TIMES ARE ZERO.
                                                                         332539
                                                                         302618
      IF (X.EG.Ø) THEN
                                                                         302520
        ATRIB(3)=0
                                                                         392638
        ATRIE (4) = 0
                                                                         332646
        RETURN
                                                                         222650
      ENDIF
                                                                         23266
                                                                        332679
  IF FAILURES OCCURED, DETERMINE TIME TO REPAIR (USING
                                                                        362498
C PARAMETERS, Y1 AND Y2, SET PREVIOUSLY). ALL TIMES COME
                                                                         302590
C FROM CAMMA DISTRIBUTIONS.
                                                                         202730
C
                                                                         002716
      IF(X.GT.#) Y=GAMA(Y1,Y2,3)
                                                                         992729
                                                                         362736
 ADJUST MX TIME IF MORE THAN ONE PART FAILED IN THIS SUBSYSTEM.
                                                                         282748
                                                                         992759
      IF(X.EQ.1) ATRIB(3)=Y
                                                                         992760
      IF(X.EQ.2) ATRIB(3)=1.5*Y
                                                                         362776
      IF(X.EQ.3) ATRIB(3)=1.75+Y
                                                                         962786
      IF(X.GE.4) ATRIB(3)=2.8+Y
                                                                         902799
                                                                         602860
C DETERMINE SUPPLY DELAY, IF ANY, IN USERF(6).
                                                                         992814
```

```
152329
                                                                       301333
     ATRIB(4) = USERF(4)
                                                                       232848
 IF THERE WILL BE A SUPPLY DELAY, DIVIDE MX TIME IN HALF.
                                                                       392858
  HALF OF THE WORK WILL BE DONE BEFORE, AND HALF AFTER, THE
                                                                       24236B
  SUFFLY DELAY.
                                                                       382973
                                                                       201990
                                                                       332898
     IF(ATRIB(4).GT.S) ATRIB(3)=ATRIB(3)/2
                                                                       892988
     RETURN
                                                                       301913
                                                                       232923
                                                                       331936
C EVENT 11. THIS EVENT CALCULATES AND FRINTS DAILY BTE
           RATES, CUMULATIVE UTE RATES, DAILY TONS/DAY,
                                                                       202940
           CUMPLATIVE TONS/DAY, AND TOTAL TONNAGE ON A
                                                                       201953
                                                                       381,948
           BAILY BASIS.
                                                                       202970
                    ---N: = CURRENT C141 FLY TIME/TONNAGE
                    ---T1 = YESTERDAY'S C141 FLY TIME/TUNAGE
                                                                       232989
                    ---NS = DURRENT OS FLY TIME/TONNAGE
                                                                       332994
                   ---TS = YESTERDAY'S OS FLY TIME/TONNAGE
                                                                       003003
                    UTE = UTILIZATION (HRS/ACFT/DAY)
                                                                        303318
                                                                        993313
                      TD = TONS/DAY
                                                                        30:33
                                                                        363343
 11 IF (TNOW.NE.24.) GG TG 43
                                                                        303053
      FLYNI=#
                                                                        993969
      TOWN: #
                                                                        993979
      CLYN5=J
                                                                        303292
      TONN5=#
                                                                        333393
 46 TODAY=TNOW/24.
                                                                        033138
      FLYT1=FLYN1
                                                                        353118
      FLYN1=XX(6)
                                                                        993129
      UTE1=(FLYN1-FLYT1)/176.
                                                                        303133
      CUTE1=FLYN1/176./TODAY
                                                                        992149
      TONT1=TONVI
                                                                        883158
      TONNIEXX (8)
                                                                        663166
      TD1=TONN1-TONT1
                                                                        003170
      CTD1=TONN1/TODAY
                                                                        993188
                                                                        663196
      FLYT5=FLYN5
                                                                        993239
      FLYN5=XX(7)
                                                                        663216
      UTES=(FLYN5-FLYT5)/53.
                                                                        003220
      CUTE5=FLYN5/53./TODAY
                                                                        863236
      TONT5=TONN5
                                                                        663249
      TONN5=XX(9)
                                                                        993259
      TD5=TONN5-TONT5
                                                                        693266
      CTD5=TONN5/TODAY
                                                                        ##327#
                                                                        003290
      TOTAL=(X(8)+XX(9)
                                                                        863298
      TD=TD1+TD5
                                                                        963399
      CTB=CTB1+CTB5
                                                                        2033:0
  461 FORMAT (/," DAY ",F3.8,33X,"C141",7X,"C5")
```

422	FGR#AT (7%, "UTE PAST 24 HRS",:2%,"#",5%,F5.2,E%,F5.2)	333322
433	FORMAT (7Xx**CE**/LATIVE GTE**x13Xx**; "xF5.2xEXxFE.2)	<b>99</b> 3335
-94	FORMAT (7%)"TON/BAY PAST 24 HRS",8%,"; ",FS.2,5%,F5.2)	203343
425	FORMAT (7X; "COMCLATIVE TORS/DAY":8X;"; ";F5.@;5X;F5.@)	<b>0</b> 513 <b>50</b>
126	FORMAT (7X, "TOTAL TONS/DAY PAST 24 HRS 1", 19X, F5.2)	<b>80</b> 30a8
497	FORMAT (7X) HIGHAL CUMULATIVE TOUS/DAY (")13X,F5.0)	203370
430	FORMAT (7X; "TOTAL TONS BELIVERED"; 7X; "; "; SX; F7.0)	993398
	PRINT 481/TODAY	883378
	PRINT 482/UTE1/UTE5	383488
	PRINT 400 POUTED POUTES	233419
	PRINT 484,TD1,TD5	283428
	PRINT 405,CTB1,CTB5	993439
	PRINT 406,TD	363446
	PRINT 407,CTD	383453
	PRINT 408 FOTAL	<i>63</i> 34 <b>.6</b>
	RETURN	323479
	END	323483

```
FINATION USERF (1)
      ]C#MeN/900M1/ ATRIB(190):DB(100):CD1(100):DTN:W:II:MF4:MST3F:MCLNR203510
     1. MORCRAAPRNI, MNRUNANNSEI MITAPEASS(188) ASSL(188) ATNEXI, TYGWAXX(188)883528
      CO TO (1/2/3/4/5/6)/I
                                                                         331E43
C+# DETERMINE ABORT MAINTENANCE TIME **
                                                                         320559
                                                                         393549
      USERF=DRAND(1) + .5
                                                                         393574
      RETURN
                                                                         8335E9
                                                                         333596
C+# DETERMINE OFFLOAD TIMES FOR C141 ##
                                                                         193609
                                                                         ag361g
      IF (ATRIB(2).E3.2) GO TO 22
                                                                         203329
      IF (DRAND(1).LE..732) GO TO 21
                                                                         000600
C ** OFFLOAD TIME FOR C141 BULK CARGO **
                                                                         003640
      USERF = RNORM (1.3,.2,1)
                                                                         9936E9
      RETURN
                                                                         353660
C ** OFFLOAD TIME FOR C141 OVERSIZE CARGO **
                                                                         233672
 21 USERF = RNORM (.84..2.1)
                                                                         465686
      RETURN
                                                                         303498
                                                                         203720
Ç
C ## CETERMINE OFFLOAD TIMES FOR C5 ##
                                                                       . 303718
                                                                         303720
 ZZ = X = DRAND(1)
                                                                         303732
      IF (X.LE..615) GO TO 23
                                                                         993749
      IF (X.LE..775) 90 TO 24
                                                                         993759
C ** OFFLOAD TIME FOR C5 BULK CARGO **
                                                                         883768
      USERF = RNORM (3.5,.5,1)
                                                                         223732
      RETURN
C ## OFFLOAD TIME FOR C5 OVERSIZE CARGO ##
                                                                         993799
 23 USERF = RNORM (2.44,.9,1)
                                                                         993892
      IF (USERF.LT..7.0R.USERF.GT.5.8) GO TO 23
                                                                         203316
      RETURN
                                                                         200823
C ** OFFLOAD TIME FOR C5 OUTSIZE CARGO **
                                                                         ##383#
 24 USERF = RNORM (2.3,.9,1)
                                                                         103848
      IF (USERF.LT..5.GR.USERF.GT.6.8) GG TO 24
                                                                         003850
                                                                         003860
                                                                         663978
C ** DETERMINE CARGO WEIGHT IN TONS **
                                                                         993889
                                                                         993899
      IF (ATRIB(2).EQ.1) GO TO 31
                                                                         193939
C ** FOR THE C5 **
                                                                         993919
      X=DRAND(5)
                                                                         ##392#
      IF (X.LE..500) GO TO 41
                                                                         663936
      IF (X.LE..923) GO TO 42
                                                                         663946
      GO TO 43
                                                                          003950
 41 X=DRAND(6)
                                                                         223962
      IF (X.LE..1111) CO TO 411
                                                                         883978
      IF (X.LE..1715) GO TO 412
                                                                         663986
      IF (X.LE..1783) GO TO 413
                                                                         993999
```

03 TJ 412  (4E *AND! 7)  IF (X.LE., 1526) 00 TO 421  IF (X.LE., 1526) 00 TO 422  IF (X.LE., 1526) 00 TO 423  IF (X.LE., 1526) 00 TO 425  IF (X.LE., 1526) 00 TO 425  IF (X.LE., 1526) 00 TO 425  IF (X.LE., 1526) 00 TO 426  00 TO 427  42 X=DRANB(8)  IF (X.LE., 122) 00 TO 431  IF (X.LE., 123) 00 TO 432  01 USERF = 414.84+(X)+14.5  RETURN  410 USERF = 82.78+(X-,1111)+89.5  RETURN  411 USERF = 735.29+(X-,1715)+94.5  RETURN  412 USERF = 3.84+(X-,1785)+99.5  RETURN  413 USERF = 53.84+(X-,1785)+99.5  RETURN  424 USERF = 136.69+(X-,2382)+29.8  RETURN  425 USERF = 132.63+(X-,5216)+64.8  RETURN  426 USERF = 538.5+(X-,6172)+74.8  RETURN  427 USERF = 16.8+(X-,7221)+99.8  RETURN  428 USERF = 175.8+(X)+25.8  RETURN  430 USERF = 58.9+(X-,28)+68.8  RETURN  431 USERF = 58.9+(X-,28)+68.8  RETURN  432 USERF = 58.9+(X-,28)+68.8  RETURN  433 USERF = 58.9+(X-,28)+68.8  RETURN  434 USERF = 58.9+(X-,28)+68.8  RETURN  435 USERF = 58.9+(X-,28)+68.8  RETURN  436 USERF = 58.9+(X-,28)+68.8  RETURN  437 USERF = 58.9+(X-,28)+68.8  RETURN  438 USERF = 68.80+(X-,88)+98.8  RETURN  439 USERF = 58.9+(X-,28)+68.8  RETURN  431 USERF = 58.9+(X-,28)+68.8  RETURN  432 USERF = 58.9+(X-,28)+68.8  RETURN  433 USERF = 58.9+(X-,28)+68.8  RETURN  434 USERF = 58.9+(X-,28)+68.8  RETURN  435 USERF = 58.9+(X-,28)+68.8  RETURN  436 USERF = 58.9+(X-,28)+68.8  RETURN  437 USERF = 58.9+(X-,28)+68.8  RETURN  438 USERF = 58.9+(X-,28)+68.8  RETURN  439 USERF = 58.9+(X-,28)+68.8  RETURN  449 USERF = 58.9+(X-,28)+68.8  RETURN  459 USERF = 58.9+(X-,28)+68.8  RETURN  469 USERF = 58.9+(X-,28)+68.8  RETURN  47 USERF = 58.9+(X-,28)+68.8  RETURN  48 USERF = 58.9+(X-,28)+68.8  RETURN  49 USERF = 58.9+(X-,28)+68.8  RETURN		•	
IF (X.LE0382) 90 TO 421 15 (X.LE0785) 90 TO 422 15 (X.LE5216) 90 TO 423 15 (X.LE6549) 90 TO 425 2		00 70 414	99439 <b>9</b>
IF (X.LE0382) 90 TO 421 15 (X.LE0785) 90 TO 422 15 (X.LE5216) 90 TO 423 15 (X.LE6549) 90 TO 425 2	42		994919
IF (X.LE3788) GO TO 422  IF (X.LE5216) GO TO 423  IF (X.LE5216) GO TO 425  IF (X.LE672) GO TO 425  IF (X.LE6722) GO TO 425  IF (X.LE6722) GO TO 426  GO TO 427  42 X=BRA\D(8)  IF (X.LE28) GO TO 431  IF (X.LE28) GO TO 432  GO TO 423  41 USERF = 414.84+(X)+14.5  RETURN  412 USERF = 82.78+(X1711)+89.5  RETURN  414 USERF = 82.78+(X1715)+94.5  RETURN  421 USERF = 3.84+(X1783)+99.5  RETURN  422 USERF = 186.89+(X2282)+29.8  RETURN  423 USERF = 130.69*(X2282)+29.8  RETURN  424 USERF = 538.5*(X5216)+64.8  RETURN  425 USERF = 538.5*(X6172)+74.6  RETURN  426 USERF = 74.4*(X5549)+94.8  RETURN  427 USERF = 175.8*(X)+25.8  RETURN  428 USERF = 75.8*(X)-228)+68.8  RETURN  430 USERF = 56.8*(X28)+68.8  RETURN  431 USERF = 56.8*(X88)+98.8  RETURN  432 USERF = 66.8*(X88)+98.8  RETURN  433 USERF = 66.8*(X88)+98.8  RETURN  434 USERF = 66.8*(X88)+98.8  RETURN  435 USERF = 66.8*(X88)+98.8  RETURN  436 USERF = 66.8*(X88)+98.8  RETURN  437 USERF = 66.8*(X88)+98.8  RETURN  438 USERF = 66.8*(X88)+98.8  RETURN  439 USERF = 66.8*(X88)+98.8  RETURN  431 USERF = 66.8*(X88)+98.8  RETURN  C = FOR THE C141 = 8  31 I=DRAND(5)  IF (X.LE589) GO TO 51  IF (X.LE923) GO TO 53  CO TO 54  31 I=DRAND(6)  IF (X.LE848) GO TO 511	-		254923
IF (X.LE5216) 30 TO 423  IF (X.LE6172) GO TO 424  IF (X.LE6172) GO TO 425  IF (X.LE624) GC TO 425  GC TO 427  42			<i>33</i> 4 <b>9</b> 33
IF (X.LE6172) GO TO 424  IF (X.LE6249) GO TO 425  IF (X.LE7221) GO TO 426  GO TO 427  42			991913
IF (X.LE6549) GC TO 425 IF (X.LE7221) GO TO 426 GC TO 427  42 X=BRAND(3) IF (X.LE22) GO TO 431 IF (X.LE28) GO TO 432 GO TO 433  411 USERF = 414.84*(X)+14.5 RETURN  412 USERF = 82.73*(X1715)+94.5 RETURN  413 JSERF = 735.29*(X1715)+94.5 RETURN  424 USERF = 3.84*(X1793)+99.5 RETURN  425 USERF = 186.69*(X2282)+29.8 RETURN  426 USERF = 186.69*(X2282)+29.8 RETURN  427 USERF = 53.9.5*(X5216)+64.8 RETURN  428 USERF = 74.4*(X6549)+94.8 RETURN  429 USERF = 74.4*(X6549)+94.8 RETURN  420 USERF = 75.8*(X)+25.8 RETURN  421 USERF = 75.8*(X)+25.8 RETURN  422 USERF = 68.8*(X7221)+99.8 RETURN  433 USERF = 68.8*(X88)+98.8 RETURN  434 USERF = 68.8*(X88)+98.8 RETURN  435 USERF = 68.8*(X88)+98.8 RETURN  436 USERF = 68.8*(X88)+98.8 RETURN  437 USERF = 68.8*(X88)+98.8 RETURN  438 USERF = 68.8*(X88)+98.8 RETURN  439 USERF = 68.8*(X88)+98.8 RETURN  431 USERF = 68.8*(X88)+98.8 RETURN  432 USERF = 68.8*(X88)+98.8 RETURN  433 USERF = 68.8*(X88)+98.8 RETURN  434 USERF = 68.8*(X88)+98.8 RETURN  435 USERF = 68.8*(X88)+98.8 RETURN  436 USERF = 68.8*(X88)+98.8 RETURN  437 USERF = 68.8*(X88)+98.8 RETURN  438 USERF = 68.8*(X88)+98.8 RETURN  449.8 RETURN  450 USERF = 68.8*(X28)+68.8 RETURN  451 USERF = 68.8*(X88)+98.8 RETURN  452 USERF = 68.8*(X88)+98.8 RETURN  453 USERF = 68.8*(X88)+98.8 RETURN  454 USERF = 68.8*(X88)+98.8 RETURN  455 USERF = 68.8*(X88)+98.8 RETURN  467 USERF = 68.8*(X88)+98.8 RETURN  478 USERF = 68.8*(X88)+98.8 RETURN  479 USERF = 68.8*(X88)+98.8 RETURN  481 USERF = 68.8*(X88)+98.8 RETURN  482 USERF = 68.8*(X88)+98.8 RETURN  483 USERF = 68.8*(X88)+98.8 RETURN  484 USERF = 68.8*(X88)+98.8 RETURN  485 USERF = 68.8*(X88)+98.8 RETURN  486 USERF = 68.8*(X88)+98.8 RETURN  487 USERF = 68.8*(X88)+98.8 RETURN  488 USERF = 68.8*(X88)+98.8 RETURN  489 USERF = 68.8*(X88)+98.8 RETURN  489 USERF = 68.8*(X88)+98.8 RETURN  480 USERF = 68.8*(X88)+98.8 RETURN  487 USERF = 68.8*(X88)+98.8 RETURN  488 USERF = 68.8*(X88)+98.8 RETURN  489 USERF = 68.8*			ð <u>ű</u> 4 15 <b>8</b>
IF (X.LE7221) GG TO 426 GC TO 427 43			204969
GC TO 427  42			264679
### ### ##############################		• • • • • • • • • • • • • • • • • • • •	994923
IF (X.LE23) GO TO 431 IF (X.LE88) GO TO 432 GO TO 432 GO TO 433  11 USERF = 414.84+(X)+14.5 RETURN  412 USERF = 82.78*(X1111)+89.5 RETURN  413 JSERF = 765.29*(X1715)+94.5 RETURN  414 USERF = 3.84*(X1783)+99.5 RETURN  421 USERF = 62.99*(X)+14.5 RETURN  422 USERF = 136.69*(X2382)+29.3 RETURN  423 USERF = 132.63*((3788)+44.8 ITCRN  424 JSERF = 52.3*(X5216)+64.8 RETURN  425 USERF = 538.5*(X6172)+74.8 RETURN  426 USERF = 74.4*(X6549)+94.8 RETURN  427 USERF = 16.8*(X7221)+99.8 RETURN  431 USERF = 175.8*(X)+25.8 RETURN  432 USERF = 58.8*(X28)+68.8 RETURN  433 USERF = 68.8*(X88)+96.8 RETURN  434 USERF = 68.8*(X88)+96.8 RETURN  435 USERF = 68.8*(X88)+96.8 RETURN  436 USERF = 68.8*(X88)+96.8 RETURN  437 USERF = 68.8*(X88)+96.8 RETURN  438 USERF = 68.8*(X88)+96.8 RETURN  439 USERF = 68.8*(X88)+96.8 RETURN  431 USERF = 68.8*(X88)+96.8 RETURN  433 USERF = 68.8*(X88)+96.8 RETURN  434 USERF = 68.8*(X88)+96.8 RETURN  435 USERF = 68.8*(X88)+96.8 RETURN  436 USERF = 68.8*(X88)+96.8 RETURN  437 USERF = 68.8*(X88)+96.8 RETURN  438 USERF = 68.8*(X88)+96.8 RETURN  449 USERF = 58.8*(X88)+96.8 RETURN  449 USERF = 58.8*(X88)+96.8 RETURN  458 USERF = 68.8*(X88)+96.8 RETURN  469 USERF = 68.8*(X88)+96.8 RETURN  478 USERF = 58.8*(X88)+96.8 RETURN  479 USERF = 58.8*(X88)+96.8 RETURN  470 USERF = 58.8*(X88)+96.8 RETURN  471 USERF = 58.8*(X88)+96.8 RETURN  471 USERF = 58.8*(X88)+96.8 RETURN  472 USERF = 58.8*(X88)+96.8 RETURN  471 USERF = 58.8*(X88)+96.8 RETURN  471 USERF = 58.8*(X88	47		204079
IF (X.LE89) GO TO 432 GO TO 433  11 USERF = 414.84+(X)+14.5 RETURN  412 USERF = 82.78+(X1111)+89.5 RETURN  413 JSERF = 733.29+(X1715)+94.5 RETURN  414 USERF = 3.84+(X1783)+99.5 RETURN  421 USERF = 62.99+(X)+14.5 RETURN  422 USERF = 62.99+(X)+14.5 RETURN  423 USERF = 196.69+(X2202)+29.8 RETURN  424 JSERF = 52.3+(X5216)+64.8 RETURN  425 USERF = 539.5+(X6172)+74.8 RETURN  426 USERF = 74.4+(X6549)+94.8 RETURN  427 USERF = 16.8+(X7221)+99.8 RETURN  431 USERF = 175.8+(X)+25.8 RETURN  432 USERF = 58.9+(X29)+68.8 RETURN  433 USERF = 68.8+(X29)+68.8 RETURN  434 USERF = 68.8+(X29)+68.8 RETURN  435 USERF = 68.8+(X29)+68.8 RETURN  436 USERF = 68.8+(X29)+68.8 RETURN  437 USERF = 68.8+(X29)+68.8 RETURN  438 USERF = 68.8+(X29)+68.8 RETURN  439 USERF = 68.8+(X29)+68.8 RETURN  440 USERF = 58.9+(X29)+68.8 RETURN  441 USERF = 58.9+(X29)+68.8 RETURN  442 USERF = 68.8+(X29)+68.8 RETURN  443 USERF = 68.8+(X29)+68.8 RETURN  444 USERF = 58.9+(X29)+68.8 RETURN  445 USERF = 58.9+(X29)+68.8 RETURN  446 USERF = 58.9+(X29)+68.8 RETURN  447 USERF = 58.9+(X29)+68.8 RETURN  448 USERF = 58.9+(X29)+68.8 RETURN  449 USERF = 58.9+(X29)+68.8 RETURN  458 USERF = 58.9+(X29)+68.8 RETURN  469 USERF = 58.9+(X29)+68.8 RETURN  479 USERF = 58.9+(X29)+68.8 RETURN  489 USERF = 58.9+(X29)+68.8 RETURN  499 USERF = 58.9+(X29)+68.8 RETURN  490 USERF = 58.9+(X29)+68.8 RETURN  490 USERF = 58.9+(X29)+68.8 RETURN  490 USERF = 58.9+(X29)+	•		884138
C3 T0 433  11 USERF = 414.84+(X)+14.5 RETURN  412 USERF = 82.78+(X1111)+89.5 RETURN  413 JSERF = 733.29+(X1715)+94.5 RETURN  414 USERF = 3.84+(X1793)+99.5 RETURN  421 USERF = 62.99+(X)+14.5 RETURN  422 USERF = 136.69+(X2282)+29.8 RETURN  423 USERF = 132.63*(X3788)+44.8 ITCRN  424 JSERF = 52.3+(X5216)+64.8 RETURN  425 USERF = 539.5*(X6172)+74.8 RETURN  426 USERF = 74.4*(X6549)+94.8 RETURN  427 USERF = 16.3*(X7221)+99.8 RETURN  431 USERF = 175.8*(X)+25.8 RETURN  432 USERF = 56.8*(X26)+68.8 RETURN  433 USERF = 68.8*(X88)+98.8 RETURN  C ++ FOR THE C141 ++ 31 X=DRAND(5) IF (X.LE588) GO TO 51 IF (X.LE692) GO TO 52 IF (X.LE923) GO TO 53 GO TO 54  51 X=DRAND(6) IF (X.LE923) GO TO 51			274118
11 USERF = 414.84+(X)+14.5 RETURN  412 USERF = 82.78+(X1111)+89.5 RETURN  413 USERF = 735.29+(X1715)+94.5 RETURN  414 USERF = 3.84+(X1783)+99.5 RETURN  421 USERF = 62.99+(X)+14.5 RETURN  422 USERF = 136.69+(X2302)+29.8 RETURN  423 USERF = 132.63*((3708)+44.8 ITCRN  424 USERF = 538.5*(X5216)+64.8 RETURN  425 USERF = 538.5*(X6172)+74.8 RETURN  426 USERF = 74.4*(X6549)+94.8 RETURN  427 USERF = 16.8*(X7221)+99.8 RETURN  431 USERF = 175.8*(X)+25.8 RETURN  432 USERF = 58.8*(X20)+68.8 RETURN  433 USERF = 68.8*(X30)+98.8 RETURN  C ++ FOR THE C141 ++ 31 X=DRAND(5) IF (X.LE588) GO TO 51 IF (X.LE692) GO TO 52 IF (X.LE923) GO TO 53 GO TO 54  51 X=DRAND(6) IF (X.LE923) GO TO 511			394123
RETURN  412 USERF = 82.78*(X1111)+89.5 RETURN  413 JSERF = 735.29*(X1715)+94.5 RETURN  414 USERF = 3.94*(X1793)+99.5 RETURN  421 USERF = 62.99*(X)+14.5 RETURN  422 USERF = 136.69*(X2292)+29.3 RETURN  423 USERF = 132.63*(X3798)+44.3 ITCRN  424 USERF = 52.3*(X5216)+64.3 RETURN  425 USERF = 539.5*(X6172)+74.8 RETURN  426 USERF = 74.4*(X6549)+94.8 RETURN  427 USERF = 16.8*(X7221)+99.8 RETURN  431 USERF = 175.8*(X)+25.8 RETURN  432 USERF = 56.8*(X29)+68.8 RETURN  433 USERF = 66.8*(X88)+98.8 RETURN  C ** FOR THE C141 ** 31 X-DRAND(5) IF (X.LE588) GO TO 51 IF (X.LE692) GO TO 53 GO TO 54  51 X-DRAND(6) IF (X.LE923) GO TO 53	411		994:39
412 USERF = 82.78*(X1111)+89.5 RETURN 413 JSERF = 735.29*(X1715)+94.5 RETURN 414 USERF = 3.94*(X1783)+99.5 RETURN 421 USERF = 62.99*(X)+14.5 RETURN 422 USERF = 136.69*(X2392)+29.3 RETURN 423 USERF = 132.63*(X3798)+44.3 ITURN 424 USERF = 52.3*(X5216)+64.3 RETURN 425 USERF = 539.5*(X6172)+74.6 RETURN 426 USERF = 74.4*(X6549)+94.9 RETURN 427 USERF = 16.8*(X7221)+99.8 RETURN 431 USERF = 175.8*(X)+25.8 RETURN 432 USERF = 55.9*(X29)+68.6 RETURN 433 USERF = 56.8*(X89)+96.8 RETURN 434 USERF = 66.8*(X89)+96.8 RETURN 435 USERF = 66.8*(X99)+96.8 RETURN 437 USERF = 66.8*(X99)+96.8 RETURN 438 USERF = 66.8*(X99)+96.8 RETURN 439 USERF = 56.9*(X29)+68.6 RETURN 431 USERF = 66.8*(X99)+96.8 RETURN 432 USERF = 56.9*(X29)+68.6 RETURN 433 USERF = 66.8*(X99)+96.8 RETURN 434 USERF = 56.9*(X99)+96.8 RETURN 456 USERF = 56.9*(X99)+96.8 RETURN 467 USERF = 56.8*(X99)+96.8 RETURN 478 USERF = 56.8*(X99)+96.8 RETURN 489 USERF = 56.8*(X99)+96.8 RETURN 490 USERF = 56.8*(X99)+96.8 RETURN 491 USERF = 56.8*(X99)+96.8 RETURN 491 USERF = 56.8*(X99)+96.8 RETURN 492 USERF = 56.8*(X99)+96.8 RETURN 493 USERF = 56.8*(X99)+96.8 RETURN 493 USERF = 56.8*(X99)+96.8 RETURN 494 USERF = 56.8*(X99)+96.8 RETURN 495 USERF = 56.8*(X99)+96.8 RETURN 496 USERF = 56.8*(X99)+96.8 RETURN 497 USERF = 56.8*(X99)+96.8 RETURN 497 USERF = 56.8*(X99)+96.8 RETURN 498 USERF = 575.8*(X5216)+54.8 RETURN 498 USERF = 575.8*(X5216)+54.8 RETURN 498 USERF = 576.8*(X5216)+54.8 RETURN 499 USERF = 576.8*(X5216)+54.8 RETURN 499 USERF = 576.8*(X5216)+54.8 RETURN 497 USERF = 576.8*(X5216)+54.8 RETURN 499 USERF = 576.8*(X5216)+54.8 RETURN 499 USERF = 576.8*(X5216)+54	••		394149
RETURN  413	412	· · ·	384158
### ### ### ### ### ### ### ### ### ##	•••	• • •	084169
RETURN  414 USERF = 3.94*(X1793)+99.5  RETURN  421 USERF = 62.99*(X)+14.5  RETURN  422 USERF = 186.69*(X2292)+29.8  RETURN  423 USERF = 132.63*(X3798)+44.8  ETGRN  424 USERF = 52.3*(X5216)+64.8  RETURN  425 USERF = 538.5*(X6172)+74.8  RETURN  426 USERF = 74.4*(X6549)+94.8  RETURN  427 USERF = 18.8*(X7221)+99.8  RETURN  431 USERF = 175.8*(X)+25.8  RETURN  432 USERF = 58.9*(X29)+68.8  RETURN  433 USERF = 68.8*(X98)+98.8  RETURN  C ** FOR THE C141 **  31 X=DRAMD(5)  IF (X.LE589) GO TO 51  IF (X.LE692) GO TO 52  IF (X.LE923) GO TO 53  GO TO 54  51 X=DRAND(6)  IF (X.LE948) GO TO 511	413		004179
414 USERF = 3.84*(X1783)+99.5 RETURN  421 USERF = 62.99*(X)+14.5 RETURN  422 USERF = 186.69*(X2282)+29.8 RETURN  423 USERF = 102.63*(X3788)+44.8 ETGRN  424 USERF = 52.3*(X5216)+64.8 RETURN  425 USERF = 538.5*(X6172)+74.8 RETURN  426 USERF = 74.4*(X6549)+94.8 RETURN  427 USERF = 18.3*(X7221)+99.8 RETURN  431 USERF = 175.8*(X)+25.8 RETURN  432 USERF = 58.8*(X28)+68.8 RETURN  433 USERF = 68.8*(X88)+96.8 RETURN  C ++ FOR THE C141 ++ 31 X=DRAND(5) IF (X.LE588) GO TO 51 IF (X.LE692) GO TO 52 IF (X.LE923) GO TO 53 GO TO 54  51 X=DRAND(6) IF (X.LE848) GO TO 511			284198
RETURN  421 USERF = 62.99*(X)+14.5 RETURN  422 USERF = 136.69*(X2202)+29.8 RETURN  423 USERF = 132.63*(X3708)+44.8 ITCRN  424 USERF = 538.5*(X6172)+74.8 RETURN  425 USERF = 538.5*(X6172)+74.8 RETURN  426 USERF = 74.4*(X6549)+94.8 RETURN  427 USERF = 16.8*(X7221)+99.8 RETURN  431 USERF = 175.8*(X)+25.8 RETURN  432 USERF = 58.8*(X29)+68.8 RETURN  433 USERF = 68.8*(X38)+96.8 RETURN  C +* FOR THE C141 +* 31 X=DRAMD(5) IF (X.LE508) GO TO 51 IF (X.LE692) GO TO 52 IF (X.LE923) GO TO 53 GO TO 54  51 X=DRAND(6) IF (X.LE948) GO TO 511	4:4	·	994:98
421 USERF = 62.99*(X)+14.5 RETURN  422 USERF = 186.69*(X2282)+29.8 RETURN  423 USERF = 132.63*(X3788)+44.8 ITORN  424 USERF = 52.3*(X5216)+64.8 RETURN  425 USERF = 538.5*(X6172)+74.8 RETURN  426 USERF = 74.4*(X6549)+94.8 RETURN  427 USERF = 16.8*(X7221)+99.8 RETURN  431 USERF = 175.8*(X)+25.8 RETURN  432 USERF = 58.9*(X29)+68.8 RETURN  433 USERF = 68.9*(X38)+96.8 RETURN  C ** FOR THE C141 ** 31 X=DRAND(5) IF (X.LE586) CO TO 51 IF (X.LE692) GO TO 52 IF (X.LE923) GO TO 53 CO TO 54  51 X=DRAND(6) IF (X.LE846) CO TO 511		***	884238
RETURN  422 USERF = 196.69*(X2392)*29.8 RETURN  423 USERF = 132.63*(X3798)*44.8 ITCRN  424 USERF = 52.3*(X5216)*64.8 RETURN  425 USERF = 539.5*(X6172)*74.8 RETURN  426 USERF = 74.4*(X6549)*94.8 RETURN  427 USERF = 16.8*(X7221)*99.8 RETURN  431 USERF = 175.8*(X)*25.8 RETURN  432 USERF = 58.8*(X26)*68.8 RETURN  433 USERF = 68.8*(X80)*96.8 RETURN  C ** FOR THE C141 ** 31 X=BRAND(5) IF (X.LE569) GD TO 51 IF (X.LE692) GD TO 52 IF (X.LE923) GD TO 53 GD TO 54  51 X=DRAND(6) IF (X.LE848) GD TO 511	421	man a m	234210
422 USERF = 186.89*(X2382)*29.8 RETURN  423 USERF = 102.63*(X3788)*44.8 ETURN  424 USERF = 52.3*(X5216)*64.8 RETURN  425 USERF = 538.5*(X6172)*74.8 RETURN  426 USERF = 74.4*(X6549)*94.8 RETURN  427 USERF = 18.8*(X7221)*99.8 RETURN  431 USERF = 175.8*(X)*25.8 RETURN  432 USERF = 58.8*(X28)*68.8 RETURN  433 USERF = 68.8*(X88)*96.8 RETURN  C ** FOR THE C141 ** 31 X=DRAND(5) IF (X.LE588) CO TO 51 IF (X.LE692) CO TO 52 IF (X.LE923) GO TO 53 GO TO 54  51 X=DRAND(6) IF (X.LE848) GO TO 511	•••		384223
RETURN  423 USERF = 132.63*(13708)+44.8  170RN  424 USERF = 52.3*(15216)+64.8  RETURN  425 USERF = 538.5*(16172)+74.8  RETURN  426 USERF = 74.4*(16549)+94.8  RETURN  427 USERF = 18.8*(17221)+99.8  RETURN  431 USERF = 175.8*(1)+25.8  RETURN  432 USERF = 58.8*(128)+68.8  RETURN  C ** FOR THE C141 **  31	422		834238
423 USERF = 132.63*(X3708)+44.8  ##################################			884249
### 170 Page 15  ### 1	423	USERF = 132.63*(13708)+44.6	204259
424 JSERF = 52.3*(X5216)+64.8  RETURN  425 USERF = 538.5*(X6172)+74.8  RETURN  426 USERF = 74.4*(X6549)+94.8  RETURN  427 USERF = 16.8*(X7221)+99.8  RETURN  431 USERF = 175.8*(X)+25.8  RETURN  432 USERF = 58.8*(X28)+68.8  RETURN  C ** FOR THE C141 **  31 X=BRAND(5)  IF (X.LE588) GO TO 51  IF (X.LE592) GO TO 52  IF (X.LE923) GO TO 53  GO TO 54  51 X=DRAND(6)  IF (X.LE848) GO TO 511		• • • • • • • • • • • • • • • • • • • •	994269
RETURN  425 USERF = 538.5*(X6172)+74.8 RETURN  426 USERF = 74.4*(X6549)+94.8 RETURN  427 USERF = 16.8*(X7221)+99.8 RETURN  431 USERF = 175.8*(X)+25.8 RETURN  432 USERF = 58.8*(X28)+68.8 RETURN  433 USERF = 68.8*(X88)+96.8 RETURN  C ** FOR THE C141 ** 31 X=DRAND(5) IF (X.LE588) GO TO 51 IF (X.LE592) GO TO 52 IF (X.LE923) GO TO 53 GO TO 54  51 X=DRAND(6) IF (X.LE848) GO TO 511	424		184278
RETURN  426 USERF = 74.4+(x6549)+94.8 RETURN  427 USERF = 16.8+(x7221)+99.8 RETURN  431 USERF = 175.8+(x)+25.8 RETURN  432 USERF = 58.8+(x28)+68.8 RETURN  433 USERF = 68.8+(x88)+96.8 RETURN  C ++ FOR THE C141 ++ 31 x-DRAND(5) IF (x.LE588) GO TO 51 IF (x.LE692) GO TO 52 IF (x.LE923) GO TO 53 GO TO 54  51 x-DRAND(6) IF (x.LE848) GO TO 511		RETURN	994280
426 USERF = 74.4+(X6549)+94.8 RETURN  427 USERF = 18.8*(X7221)+99.8 RETURN  431 USERF = 175.8*(X)+25.8 RETURN  432 USERF = 58.8*(X28)+68.8 RETURN  433 USERF = 68.8*(X88)+98.8 RETURN  C ** FOR THE C141 ** 31 X=DRAND(5) IF (X.LE588) GO TO 51 IF (X.LE692) GO TO 52 IF (X.LE923) GO TO 53 GO TO 54  51 X=DRAND(6) IF (X.LE848) GO TO 511	425	USERF = 530.5*(X6172)+74.0	994299
RETURN  427 USERF = 16.8*(X7221)+99.8 RETURN  431 USERF = 175.8*(X)+25.8 RETURN  432 USERF = 58.8*(X28)+68.8 RETURN  433 USERF = 68.8*(X88)+98.8 RETURN  C ** FOR THE C141 ** 31 X=DRAND(5) IF (X.LE588) GO TO 51 IF (X.LE692) GO TO 52 IF (X.LE923) GO TO 53 GO TO 54  51 X=DRAND(6) IF (X.LE848) GO TO 511		RETURN	034300
427 USERF = 16.8*(X7221)+99.8 RETURN  431 USERF = 175.8*(X)+25.8 RETURN  432 USERF = 58.8*(X26)+68.6 RETURN  433 USERF = 68.8*(X86)+96.8 RETURN  C ** FOR THE C141 ** 31 X=DRAND(5) IF (X.LE566) GO TO 51 IF (X.LE692) GO TO 52 IF (X.LE923) GO TO 53 GO TO 54  51 X=DRAND(6) IF (X.LE846) GO TO 511	426	USERF = 74.4+(X6549)+94.8	<b>004</b> 31 <b>0</b>
RETURN  431 USERF = 175.8*(X)+25.8 RETURN  432 USERF = 58.8*(X28)+68.8 RETURN  433 USERF = 68.8*(X88)+98.8 RETURN  C ** FOR THE C141 ** 31 X=BRAND(5) IF (X.LE588) GO TO 51 IF (X.LE692) GO TO 52 IF (X.LE923) GO TO 53 GO TO 54  51 X=DRAND(6) IF (X.LE848) GO TO 511		RETURN	884329
431 USERF = 175.0 + (X) + 25.0 RETURN  432 USERF = 50.0 + (X20) + 60.0 RETURN  433 USERF = 60.0 + (X80) + 90.0 RETURN  C + FOR THE C141 ++ 31 X = DRAND(5) IF (X.LE500) GO TO 51 IF (X.LE692) GO TO 52 IF (X.LE923) GO TO 53 GO TO 54  51 X = DRAND(6) IF (X.LE840) GO TO 511	427	USERF = 16.8*(X7221)+99.8	<b>894</b> 33 <b>9</b>
RETURN  432 USERF = 59.9*(X29)+68.8 RETURN  433 USERF = 68.9*(X98)+99.8 RETURN  C ** FOR THE C141 ** 31 X=BRAND(5) IF (X.LE588) GO TO 51 IF (X.LE692) GO TO 52 IF (X.LE923) GO TO 53 GO TO 54  51 X=DRAND(6) IF (X.LE848) GO TO 511		RETURN	<b>994</b> 34 <b>3</b>
432 USERF = 59.8*(x29)+68.8 RETURN  433 USERF = 68.8*(x98)+98.8 RETURN  C ** FOR THE C141 ** 31	431	USERF = 175.8+(X)+25.8	00435 <b>0</b>
RETURN  433 USERF = 68.8*(X88)+98.8 RETURN  C ** FOR THE C141 ** 31 X=DRAND(5) IF (X.LE588) GO TO 51 IF (X.LE692) GO TO 52 IF (X.LE923) GO TO 53 GO TO 54  51 X=DRAND(6) IF (X.LE848) GO TO 511		RETURN	<i>09</i> 436 <i>9</i>
433 USERF = 68.8*(X88)+98.8 RETURN  C ** FOR THE C141 ** 31 X=DRAND(5) IF (X.LE588) GO TO 51 IF (X.LE692) GO TO 52 IF (X.LE923) GO TO 53 GO TO 54  51 X=DRAND(6) IF (X.LE848) GO TO 511	432	USERF = 58.8+(X29)+68.8	694379
RETURN  C ++ FOR THE C141 ++  31		RETURN	984389
C ** FOR THE C141 **  31	433	· · · · · · · · · · · · · · · · · · ·	664376
31			931138
IF (X.LE500) GO TO 51 IF (X.LE692) GO TO 52 IF (X.LE923) GO TO 53 GO TO 54 51	C ##		884418
IF (X.LE692) GO TO 52 IF (X.LE923) GO TO 53 GO TO 54 51	31		894429
IF (X.LE923) GO TO 53 GO TO 54 51			994439
GO TO 54 51 X=DRAND(6) IF (X.LE#40) GO TO 511			<b>894448</b>
51 X=DRAND(6) IF (X.LE#4#) GO TO 511			894458
IF (X.LE#48) GO TO 511			394469
	51		994479
IF (X.LE., 2166) GO TO 51Z			964438
	_	IF (X.LE2166) GO TO 51Z	994499

	IF (X.LE2182) GO TO FLE	894533
	IF (Y.LE., 4785) GO TO 514	894713
	IF (X.LE6135) 50 TO F.E	334513
	IF (X.LE6938) GO TO 516	991539
	90 70 517	334543
-	X=BRAND(7)	364552
	IF (X.LE995) GO TO 521	234568
	IF (X.LE.,265) GO TO 522	994573
	IF (X.LE255) GO TO 523	234582
	IF (X.LE555) GO TO 524	394598
	IF (X.LE565) 90 T0 525	33-423
	IF (X.LE890) GO TO 526	384419
	\$0.79.527	284613
53	X=BRANB(9)	3 <b>94</b> 63 <b>3</b>
,,	IF (X.LE1125) GO TO 531	394048
	IF (X.LE105) GO TO E32	234,53
	IF (X,LE.,415) GO TO 533	234663
	IF (X.LE470) G3 T6 534	20467 è
	IF (X.LE785) GO TO 535	38468 <b>3</b>
	IF (X.LE795) GO TO 536	22469 <b>8</b>
	1F (X.1E920) GC TO 537	994739
	90 TO 538	304713
54	X=9RAND(9)	39472 <b>9</b>
•••	IF (X.LE210) GO TO 541	394723
	IF (X.LE460) GO TO 542	9 <b>047</b> 43
	IF (X.LE750) GO TO 543	234753
	IF (X.LE875) GO TO 544	394769
	GO TO 545	934779
511	USERF = 125.0+(X)+6.0	304780
411	RETURN	38479 <b>9</b>
512	USERF = 16.99*(X04)+11.0	204839
4.2	RETURN	20481 <b>0</b>
513	USERF = 58.14+(X2166)+14.8	394823
31.3	RETURN	024830
514	USERF = 33.16*(X268Z)+17.8	394249
717	RETURN	394859
515	USERF = 72.99*(X4765)+24.8	894868
919	RETURN	20487 <b>0</b>
516	USERF = 24.91*(X6135)+34.0	##488 <b>#</b>
210	RETURN	<b>984</b> 898
517	USERF = 13.86*(X6938)+36.8	884988
317		984918
521	RETURN USERF = 52.63#(X)+6.#	884928
77.1	RETURN	994939
522	USERF = 17.65+(X895)+11.8	88474 <b>3</b>
JLL	RETURN	884958
523	USERF = 2866+(X265)+14.6	<b>66</b> 496 <b>6</b>
323	USERF = 2888*(X-,203)*14.8 RETURN	49497 <b>6</b>
524		#6448#
JLF	WSERF = 27.08*(A200)*10.#	664996
	חדו טחח	#777 <b>#</b>

```
525 USERF = 1001+(X-.555)+24.0
                                                                     48° . 38
     12 TAN
                                                                     . 35813
526 USERF = 6.15*(X+.555)+34.8
                                                                     0050_0
                                                                     135 333
     RETURN
527 LSERF = 36.36*(X-.89#)+36.#
                                                                     305042
                                                                     885858
     RETURN
531 USERF = 35.55+(X)+2.8
                                                                     325348
     RETURN
                                                                     305073
532 USERF = 54.85*(X-.1125)+6.8
                                                                     005:30
     RETURN
                                                                     005398
533 USERF = 14.29*(X-.205)+11.0
                                                                     905.30
     RETERN
                                                                     305110
534 USERF = 90.91*\/-.415\+14.0
                                                                     285129
     RETURN
                                                                     995:33
535 USERF = 15.87*(X-.478)+19.8
                                                                     205:40
                                                                     235158
     RETURN
586 USERF = 1880+(X-.785)+24.8
                                                                     325163
                                                                     995:73
     RETURN
537 USERF = 16.00+(X-.795)+34.0
                                                                     005190
                                                                     005190
     RETURN
538 USERF = 58.884(X-.926)+36.8
                                                                     335229
     RETURN
                                                                     3352:3
541 USERF = 19.0E*(X)+9.0
                                                                     335123
                                                                     395239
     RETURN
542 USERF = 8.89+(X-.218)+13.6
                                                                     005240
                                                                     695259
     RETURN
                                                                     335248
543 USERF = 34.45+(X-.46#)+15.#
                                                                     135279
      RETURN
                                                                     305280
 544 USERF = 16.0+(x-.750)+25.0
                                                                     30E173
     RETURN
                                                                     885300
545 USERF = 32.8+(X-.875)+27.8
     RETURN
                                                                     995319
                                                                     005320
                                                                     005330
C ** DETERMINE C141 TURNAROUND TIME **
                                                                     365346
                                                                     995359
C ** USERF(4) = POSTFLIGHT + REFUELING + MX PREFLIGHT
                                                                     665366
                                                                     865376
     USERF = RNORM(.7,.88,4)+UNFRM(1.5,2.5,4)+RNORM(.7,.88,4)
                                                                     0053S0
                                                                     005390
     RETURN
                                                                     205490
C ** DETERMINE C5 TURNARGUND TIME **
                                                                     005418
                                                                     005428
                                                                     665436
C ## USERF(5) = POSTFLIGHT + REFUELING + MX PREFLIGHT
                                                                     885448
                                                                     305450
     USERF=RNORM(1.5,.12,5)+UNFRM(2.#,4.#,5)+RNORM(1.5,.12,5)
                                                                     885468
                                                                     805476
995486
C THIS FUNCTION IS USED TO DETERMINE HOW LONG AN ACFT **
                                                                     605496
```

```
0 IS 20WN WHILE WAITING FOR SUPPLY. NOTE THAT SUPPLY **
                                                                     1055:3
C IS NOT A FACTOR FOR THE FIRST 12 DAYS (233 HOURS) ++
                                                                     105510
O THIS IS BUE TO LOCAL STOCK AND WASK STOCKPILES.
                                                     ##
                                                                     005510
305530
                                                                     3655-3
                                                                     305550
C** FIRST, DETERMINE IF SUPPLY IS A FACTOR **
                                                                     33555J
    IF (DRAND(3).LE..95) 60 TO 10#
                                                                     225570
                                                                     305580
     IF (TNOW.LE.288) GO TO 363
                                                                     325598
                                                                     305600
0## FOR THE 0141 ##
                                                                     ##E6:3
      IF (ATRIB(2).EQ.2) GO TO 30
                                                                     605610
                                                                     995639
      X=DRAND(3)
      IF (X.LE..204) GO TO 391
                                                                     205640
      IF (X.LE..339) GO TO 322
                                                                     185559
      GO TO 303
                                                                     0056c2
 300 USER5=0
                                                                     235673
                                                                     835e38
      RETURN
 301 USERF=(5000.+(X)+24.)+1.0
                                                                     895698
                                                                     865788
      RETURN
 302 USERF=(73.62#(X-.004)+48.)+1.8
                                                                     805710
                                                                     995729
      RETURN
                                                                     885738
 303 USERF=(143.28*(X-.330)+72.)+1.0
                                                                     205740
      RETURN
                                                                     305750
                                                                     005750
C## FOR THE C5 ##
                                                                     305773
 39
     X=BRAND(3)
                                                                     995789
      IF (X.LE..002) GO TO 364
                                                                     305793
                                                                     905830
      IF (X.LE..233) GO TO 305
      IF (X.LE..323) GO TO 306
                                                                     395819
      IF (X.LE..338) GO TO 307
                                                                     365E20
      IF (X.LE..585) CO TO 308
                                                                     305833
                                                                     995849
      GO TO 329
                                                                     #95859
 384 USERF=(12888.+(X)+24.)+1.8
                                                                     305860
      RETURN
 395 USERF=(193.9+(X-.092)+48.)+1.9
                                                                     995879
      RETURN
                                                                     005880
 3#6 USERF=(266.67+(X-.233)+72.)+1.9
                                                                     995399
                                                                     995999
      RETURN
                                                                     365918
 367 USERF=(1668.+(X-.323)+96.)+1.8
                                                                     885928
      RETURN
 388 USERF=(97.17+(X-.338)+128.)+1.8
                                                                     885938
                                                                     995949
      RETURN
                                                                     605950
 3#9 USERF=(57.83*(X-.585)+144.)+1.#
                                                                     995969
      RETURN
                                                                     965979
```

```
TTWO BASE CONTERT OF STRATEGIC AIRLIFT: U.S. TO EUROPE
                                                                     -325333
GEN, STANBERRY, HK THESIS, 11/29/1991)
                                                                      304318
118,31,6,5000;
                                                                      336926
TIMET/XX(1)/C141 WOUT LEF
                                                                      206630
TI/ST,XX(2),C141 WITH LEF
                                                                     026240
TIMST . XX(8) . C5 WITH LEF
                                                                     395259
TEMST.XX(4).C5 WOUT LES
                                                                      106061
TIMST, XX(5), NUMBER LE FREED;
                                                                     986979
TIMST.XX(6).C141 FLY TIME;
                                                                     236383
TIMST, XX(7), CE FLY TIME!
                                                                      006090
TIMST,XX(8),C141 TONNAGE;
                                                                     236120
TIMST, XX(9), C5 TONNAGE;
                                                                     306:12
NETWORKS
                                                                     306:22
                         C141 AIRCRAFT
     RES/C141(176)+1;
                                                                     236139
     RES/C5(53),2;
                         CS AIRCRAFT
                                                                     386143
                      LOAD EQUIP IN U.S.
     RES/LEUS(28),3;
                                                                     306150
                         LOAD PERSONNEL IN U.S.
     RES/LPUS(76),4;
                                                                     306163
                         C141 AIRCREWS IN U.S.
     RES/AC1U(352),5;
                                                                     966179
     RES/AC5U(86) +6;
                         C5 AIRCREWS IN U.S.
                                                                     836188
     RES/LEEUR (28) ,7;
                           LCAD EQUIP IN EUROPE
                                                                     206193
     RES/LPEUR (70) +8;
                           LOAD PERSONNEL IN EUROPE
                                                                     396299
     RES/AC1E(352),9;
                           C141 AIRCREWS IN EUROPE
                                                                     626219
     RES/ACSE(86),18;
                           C5 AIRCREWS IN EUROPE
                                                                     884228
     RES/M431R2(74):11;
                             FLT CONTROLS MX PERS
                                                                     396238
                             LANDING GEAR MX PERS
      RES/M43192(18),12;
                                                                      286248
      RES/M423XØ(43) +13;
                             ELECTRICAL SYSTEMS MX FERS
                                                                      006250
      RES/M423X4(57),14;
                             PNEUDRAULICS MX PERS
                                                                      936266
      RES/M426X2(193)+15;
                             ENGINE MY PERS
                                                                      396279
                             ENVIRONMENTAL SYSTEMS MX PERS
     RES/M423X1(46)+16;
                                                                     266286
                             FUEL SYSTEMS MX PERS
     RES/M423X3(28),17;
                                                                     306290
     RES/M325X1(45):18;
                             INSTRUMENTS MX PERS
                                                                     996399
      RES/MS25X@(37):191
                             ALTOPILOT MX PERS
                                                                      885316
                             NAVIGATION SYSTEMS MX PERS
      RES/M328X1(49),28;
                                                                      296324
      RES/M328X4(36);21;
                             INS & RADAR MX PERS
                                                                      396333
                                                                      896349
FINITIALIZE THE MODEL FOR USER FORMATTED DATA
                                                                      006350
                                                                      996369
      CRE,24,24;
                                                                      ##637#
      ACT,,,EV11;
                                                                      936389
EVII EVE, II;
                                                                      966399
      TERM;
                                                                      666466
                                                                     996418
CREATE A NEW LOAD EVERY 6 MINUTES
                                                                      886428
                                                                      886436
      CRE, .16, ,1;
                                                                      846444
      ACT: NNQ(1).LT.1:AS1;
                                                                      446454
      ACT, ,NNQ(2) .LT.1,AS2;
                                                                     995469
AS1 ASS,ATRIB(2)=1,ATRIB(1)=ATRIB(1)+.61;
                                                                     396479
                                                                     86486
      ACT . . . A141;
```

```
136153
FRAIT FOR A CIAL. 41.4% WILL REQUIRE LOAD EQUIPMENT
                                                                          336522
                                                                          326513
A141 AWA(1)/0141/1/18
                                                                          236513
      ACT::.586:4831
                                                                          394533
      ACT,,,414,AS4;
                                                                          196519
ASS ASS,ATRIB(3)=0,ATRIB(4)=RNORM(1.3,.2).xx(1)=XX(1)+1f
                                                                          236553
      ACTITIALPI
                                                                          226553
AS4 ASS,ATRIB(3)=.1,ATRIB(4)=RMGRM(1.3,.2),XX(2)=XX(2)+1;
                                                                          336573
                                                                          306580
      ACT: HALES
    ASS,ATRIB(2)=2,ATRIB(1)=ATRIB(1)+.02;
                                                                          386598
                                                                          286583
      ACT: 1:ACS;
                                                                          8066.I
SWAIT FOR A CS. 65.2% WILL REQUIRE LOAD EQUIPMENT
                                                                          385523
                                                                          206633
                                                                          326644
405 AMA(2) (05/1)11
      ACT.,.652,ASS;
                                                                          004650
      ACT,,,348,AS6;
                                                                          336663
    ASS,ATRIB(3)=.1,ATRIB(4)=RNCRM(3.5,.6), XX(3)=XX(3)+1;
                                                                          885678
      ACT, , , ALE;
                                                                          336653
A=6 ASS,ATRIB(3)=0,ATRIB(4)=RNORM(3.5,.6),XX(4)=XX(4)+1;
                                                                          306698
      ACT: HALP!
                                                                          386738
                                                                          396713
WAIT FOR LOAD EQUIP
                                                                          326728
                                                                          996733
                                                                          226743
ALE AWA(3),LEUS/1-1;
                                                                          996759
      ACT, ,, ALPi
                                                                          385769
                                                                          396779
WHAIT FOR LOAD CREW
                                                                          296782
                                                                          886798
ALP
     AWA(4) - LPUS/1-1;
                                                                          006800
(account for Loading time. ATRIB(4) IS LOADING TIME, ATRIB(3)
                                                                          326814
JIS THE TIME IT TAKES THE LE TO GET TO THE ACFT.
                                                                          925823
JAFTER FREEING LE AND LP, ACFT ARE READY WITH CARGO AND NEED CREWS.
                                                                          206839
                                                                          206840
      ACT+ATRIB(3)+ATRIB(4);
                                                                          446854
                                                                          356363
      C00:1;
                                                                          496374
      ACT, ATRIB(3) .NE. 8, FLE;
      ACT+,ATRIB(3),EQ.#,FLP;
                                                                          888688
FLE FRE+LEUS/1;
                                                                          ##689#
      ASS . XX (5) = XX (5) +1;
                                                                          226966
      FRE, LPUS/1,1;
                                                                          986918
                                                                          886928
      ACT, ATRIB(2) .EQ.1, CIRCL
      ACT ... C2RCi
                                                                          446934
CIRC COL, INT(1), C141 CARGO REABY;
                                                                          886948
                                                                          466954
      ACT.,,AC1U;
C2RC COL, INT(1), C5 CARGO READY;
                                                                          986968
      ACT, , , AC5U;
                                                                          666976
                                                                          466984
ï
```

```
WALT FIR CLAI ALROREWS
                                                                          337334
A010 AWA (5) WAC15/17
                                                                          2:73:3
      ACT.,,AS7;
                                                                          70723
                                                                          337938
INALT FOR OS AIRCREWS
                                                                          3073-3
                                                                          227359
ACSU AWA (6), 4CSU/1;
                                                                          887368
      ACT.,,AS7;
                                                                          337373
                                                                          337338
ISTART CREW DUTY DAY 2 HOURS BEFORE REPORT TO AIRCRAFT. THIS
                                                                          2077 3
FACCOUNTS FOR CREW ASSEMBLY, ERIEFING, ETC.
                                                                          237:00
                                                                          237:19
AS7 ASS,ATRIB(5)=TNOW-2.8;
                                                                          887128
      ACT: UNFRM(1.2:1.5);
                                                                          207132
      G00N+13
                                                                          367:48
                                                                          287158
$15% OF THE AIRCRAFT WILL REQUIRE PRE-TAKEOFF MAINTENANCE.
                                                                          827:68
FILME DELAYED = USERF(1)
                                                                          397179
                                                                          387186
      ACT,,,8E,ASS;
                                                                          207199
      ACT, USERF (1) . . 15, AS8;
                                                                          207223
                                                                          3072:0
FRLIGHT TIME TO EUROPE.
                                                                          887229
                                                                          287239
                                                                          097244
ASS - ASS, ATRIB(4) = RNORM(7.7,.2);
                                                                          007250
      ACT ATRIB(4) , GO2;
                                                                          867163
GC2 GCON, 2;
                                                                          007270
                                                                          397298
ITHESE TWO STATEMENTS FOLLOW THE AIRCRAFT FOR UNLOADING, TURNAROUND,
                                                                          397299
JAND FLIGHT BACK TO THE U.S. (SEE "AIRCRAFT ROUTINE IN EUROPE")
                                                                          397388
                                                                          007310
      ACT, ATRIB(3).EQ..1, ALEE;
                                                                          697329
      ACT,,ATRIB(3).EQ.Ø,ALPE;
                                                                          997339
                                                                          007340
THESE TWO STATEMENTS FOLLOW THE AIRCREW AFTER LANDING. CREWS
                                                                          997359
IGO THRU DEBRIEFING, ETC., THEN ARE ALLOWED 12 HOURS CREWREST
                                                                          82/360
FBEFORE BEING MAKE AVAILABLE AGAIN.
                                                                          997379
į
                                                                          007380
      ACT, UNFRM(1.8,1.5), ATRIB(2).EQ.1,CO1;
                                                                          887398
      ACT: UNFRM(1.#:1.5) -ATRIB(2).EQ.2:C02;
                                                                          997489
CO1 COL, INT (5), C141 BUTY DAY;
                                                                          997415
      ASS, XX(6) = XX(6) + ATRIB(4), XX(8) = XX(8) + USERF(3);
                                                                          887428
      ACT 12.5;
                                                                          867438
      FRE, AC1E/1;
                                                                          887448
      TERM
                                                                          367456
CO2 COL, INT (5), C5 DUTY DAY;
                                                                          987469
      ASS.XX(7)=XX(7)+ATRIB(4).XX(9)=XX(9)+USERF(3);
                                                                          997479
      ACT, 12.6;
                                                                          367486
```

```
FREVALTE/1
                                                                                377293
      TERME
                                                                                3.7530
                                                                                2375.3
                                                                                127520
FAIRCRAFT ROUTINE IN EUROPE:
                                                                                997536
                                                                                307543
FLEE AWA (7) (LEEUR/1)
                                                                                207553
      ACT, , , ALPE;
                                                                                367553
ALPE AWA(8), LFEUR/1;
                                                                                387573
FUNLDAD THE ACFT
                                                                                307593
                                                                                237598
      ACT, USERF (2), . G07;
                                                                                397693
007 G00N:11
                                                                                3276:3
      ACT, ATRIB(3).E3..1,FLEE;
                                                                                887628
      ACT., ATRIE(3).EQ. Ø.FLPE;
                                                                                307633
FLEE FRE, LEEUR/1;
                                                                                337643
      ACT: . . FLPE:
                                                                                997659
FLPE FREILPEUR/11
                                                                                7 7663
      COL, INT(1), TRANSIT TIME;
                                                                                Ø67579
                                                                                997689
TAFTER THE ACFT ARE UNLOADED, SEPARATE THE 0141S FROM THE 05S
                                                                                397693
JAND PREPARE FOR THE RETURN TRIP.
                                                                                367799
                                                                                2377:3
      ACT , , ATRIB (2) .EQ. 1 , GQ5;
                                                                                387723
      ACT . ATRIB(2) .EQ. 2, GO6;
                                                                                997739
    207743
                                                                                887758
TTHIS ACTIVITY INCLUDES POSTFLIGHT, REFUELING, AND MX PREFLY OF C-141S
                                                                                007760
                                                                                297778
                                                                                807788
      ACT, UNFRM (2.0,4.0);
                                                                                887798
                                                                                897833
INON WAIT FOR A C141 AIRCREW
                                                                                007816
      AWA (9) +AC1E/1+1;
                                                                                997829
                                                                                367333
FAGAIN, 15% OF THE C141S REQUIRE SOME PRE-TAKEOFF MAINTENANCE.
                                                                                367849
                                                                                997859
      ACT, UNFRH(.5,1.5), .15, AS16;
                                                                                997869
                                                                                667878
      ACT,,.85,AS1#;
AS1# ASS,ATRIB(6) = RNORM(9.3,.2), XX(6) = XX(6) + ATRIB(6),1;
                                                                                887988
                                                                                997899
                                                                                667966
FELIGHT BACK TO THE U.S.
                                                                                997919
      ACT, ATRIB(6);
                                                                                987928
                                                                                887938
JAFTER 13.5 HOURS, CREWS ARE MADE AVAILABLE FOR US-TO-EUROPE
                                                                                897949
FFLIGHTS. THIS INCLUDES 12 HOURS FOR CREWREST.
                                                                                44795#
                                                                                847966
                                                                                667976
      COON, 2;
                                                                                $67988
      ACT:13.5: FALU;
```

```
40T,,,,0031
                                                                     337773
FAIR FREJACIS/13
                                                                     228333
     155 Y
                                                                     33:312
    327329
                                                                     228238
ITHIS ACTIVITY INCLUDES POSTFLIGHT, REFUELING, AND HX PREFLIGHT OF CES
                                                                     J#824#
                                                                     8888E8
     ACT: UNFRM (2.8,4.8);
                                                                     308363
                                                                     23:278
INOW WAIT FOR A C5 AIRCREW.
                                                                     238239
                                                                     998993
     AWA(18) , ACSE/1,1;
                                                                     238199
                                                                     308:19
THERE, 30% OF THE C5S REQUIRE SOME PRE-TAKEOFF MAINTENANCE.
                                                                     000110
                                                                     303130
     ACTICYFRM(L5:1.5):.3:AS11;
                                                                     225-10
                                                                     208153
     ACT++.7+AS111
AS11 ASS,ATRIB(6)=RNGRM(9.3,.2),XX(7)=XX(7)+ATRIB(6),1;
                                                                     388168
                                                                     338173
FFLIGHT BACK TO THE U.S.
                                                                     338188
                                                                     283198
     ACT, ATRIB(6);
                                                                     238236
                                                                     338213
FAFTER 13.5 HOURS, CREWS ARE MADE AVAILABLE FOR US-TO-EUROPE
                                                                     298223
FRLIGHTS. THIS INCLUDES 12 HOURS FOR CREWREST.
                                                                     Ø$823Ø
                                                                     868246
     G00,2;
                                                                     998259
     ACT:13.5: FA5U;
                                                                     998269
     ACT.,,G03;
                                                                     968279
FASU FRE, ACSU/17
                                                                     688286
     TERM;
                                                                     998299
                                                                     308300
208312
įį
                                                                     308323
# HERE: THE AIRCRAFT ENTERS MAINTENANCE FOR REPAIR AS FOLLOWS: #
                                                                     998339
                                                                     368346
##835#
                                                                     998366
F AIRCRAFT BRANCHES TO 16 SUBSYSTEM NETWORKS.
                                                                     998379
                                                                     268384
GG3 GOON-1#7
                                                                     668396
     ACT: , , EV1;
                                                                     998439
     ACT ... EV2;
                                                                     668416
     ACT.,,EV3;
                                                                     868426
     ACT.,,EV4;
                                                                     998439
     ACT.,,EV5;
                                                                     968446
     ACT.,,EV6;
                                                                     998459
     ACT...EV7;
                                                                     988468
     ACT...EV8;
                                                                     668476
     ACT.,,EV9;
                                                                     668486
```

```
ACT, , , EV18;
                                                                                228493
                                                                                306532
   THIS NETWORK FOLLOWS THE AIRFRAME SUBSYSTEM, W.U.C. 11.
                                                                                2085:3
                                                                                838518
# EVENT 1 DETERMINES IF THERE ARE ANY FAILURES IN THIS SUBSYSTEM
                                                                                388538
; AND SETS MAINTENANCE TIME IN ATTRIBUTE 3 AND SUPPLY DELAY TIME
                                                                                239543
                                                                                202558
; IN ATTRIBUTE 4.
                                                                                 203560
EV1 EVE:1:11
                                                                                008570
                                                                                 308589
I IF THERE WERE NO FAILURES, SO NO MAINTENANCE TIME, THE
                                                                                398599
; SUBSYSTEM GCES DIRECTLY TO WAIT IN QUEUE 1.
                                                                                998639
                                                                                9386:2
     ACT, ATRIB(3).E3.8,Q1;
                                                                                233623
                                                                                998630
; IF THERE WERE FAILURES AND THE AIRCRAFT IS A C-141.
                                                                                998649
  THE SUBSYSTEM BRANCHES TO GOON NODE: G2.
                                                                                998659
                                                                                398669
     ACT , ATRIB(2) .EQ.1,G2;
                                                                                288673
                                                                                883688
; IF THERE WERE FAILURES AND THE AIRCRAFT IS A C-5.
                                                                                308673
; THE SUBSYSTEM BRANCHES TO GOON NODE, G3.
                                                                                992799
                                                                                 302710
     ACT, ATRIB(2) .EQ. 2, G2;
                                                                                668726
                                                                                228739
; FROM G2, THE SUBSYSTEM TAKES ONLY ONE OF THE FOLLOWING SRANCHES.
                                                                                998749
; THE FIRST ACTIVITY ALWAYS REPRESENTS THE CASE WHERE A TYPE OF
  MAINTENANCE SPECIALTY NOT IN THE MODEL IS REQUIRED. THERE ARE
                                                                                308748
   NO RESOURCES ASSIGNED, BUT MAINTENANCE TIME IS ACCOUNTED FOR ON
                                                                                203779
; THE WAY TO GZZ. ALL OTHER BRANCHES REPRESENT THE PROBABILITIES
                                                                                868788
I OF NEEDING DIFFERENT SPECIALTIES THAT HAVE BEEN MODELED. IF
                                                                                308790
; ONE OF THESE IS CHOSEN, THE SUBSYSTEM GOES TO THE APPROPRIATE
                                                                                998893
   AWAIT NODE TO WAIT FOR MAINTENANCE PERSONNEL.
                                                                                398819
                                                                                 998823
 G2 G00N+1;
                                                                                 008830
      ACT, ATRIB(3), .613, G22;
                                                                                 668846
      ACT.,.303,AU1;
                                                                                 448854
      ACT.,.#84,AU4;
                                                                                 008860
                                                                                363876
; FROM G3, AGAIN ONLY ONE BRANCH IS TAKEN, BUT THESE CHOICES
                                                                                403884
   REPRESENT THE RESOURCES REQUIRED BY A C-5 FOR THIS SUBSYSTEM.
                                                                                538895
                                                                                898988
C3
      GOON+11
                                                                                 668916
      ACT, ATRIB(3), .453, G22;
                                                                                 648926
      ACT . . . 264 . AW1 ;
                                                                                 448936
      ACT ... #51 . AN3;
                                                                                 368946
      ACT: , . 232 , AM4;
                                                                                368956
                                                                                968966
F THIS METHORK FOLLOWS THE LANDING CEAR SUBSYSTEM.
                                                                                608976
; W.U.C. 13, IN THE SAME PATTERN AS ABOVE.
                                                                                448984
```

```
238999
EVC EVE/2/1/
                                                                                        291303
      ACT++ATRIB(3).E0.2+G21
                                                                                       2393:3
      40T+,47RIB(E).EG.1,G4;
      ACT: 4TRIB(2).EQ.2;65;
                                                                                        2398:2
      GCCN+14
                                                                                       229248
      ACT+ATRIB(3)+.38+022;
                                                                                        389853
      ACT., .473, AW2;
                                                                                        229363
      ACT++.145+AW3;
                                                                                        369973
      ACT.,,382,AW4;
                                                                                        289788
      G00N+13
                                                                                       309390
      ACT - ATRIB (3) + . 128 - G221
                                                                                        359.38
      ACT., 247, AW11
                                                                                        339113
      ACT::.472;AW21
                                                                                        889122
      ACT++.979+AWS+
                                                                                        009:30
      ACT . . . 281 . AWA;
                                                                                        339:48
      ACT.,. 874, AUS;
                                                                                        d39158
EV3 EVE.3.1;
                                                                                        009:60
                                                                                       309170
FITHIS NETWORK FOLLOWS THE FLIGHT CONTROLS BUBSYSTEM.
                                                                                       009:80
  W.U.C. 14, IN THE SAME PATTERN AS ABOVE.
                                                                                       339198
                                                                                       929259
      ACT, ATRIB(3) .Eq. 0,GC;
                                                                                        309213
      ACT, ATRIB(2).EQ.1,G&;
                                                                                        399223
      ACT .. ATRIB(2).EQ.2.G7;
                                                                                       309230
      COCN, 11
                                                                                       889248
      ACT+ATRIE(3) .. 189, G22;
                                                                                       309250
      ACT,,,254,AW1;
                                                                                        009260
      ACT, 1, 135, AUS;
                                                                                       339278
      ACT . . . 228 . AN4;
                                                                                       009238
      ACT., 156, AUST
                                                                                        889298
      ACT.,. $68, AU9;
                                                                                        969334
      GOON, 15
                                                                                        0093:8
       ACT, ATRIB(3), .217, G22;
                                                                                        809328
       ACT::.163:AU1;
                                                                                        809338
      ACT,,,127,AW3;
                                                                                        889346
      ACT: .. 493 - AW4;
                                                                                        839358
                                                                                        999369
   THIS METHORK FOLLOWS THE ENGINE SUBSYSTEM, W.U.C. 23,
                                                                                       009370
   IN THE SAME PATTERN AS ABOVE.
                                                                                        669386
                                                                                        889398
EV4 EVE.4.1;
                                                                                        389466
      ACT . , ATRIB(3) . EQ. 8 . Q4;
                                                                                        989418
       ACT . , ATRIB (2) .EQ. 1 . C8;
                                                                                        689425
      ACT . , ATRIB (2) . EQ . 2 . C9;
                                                                                        889438
C8
      COON, 1;
                                                                                        569415
      ACT . ATRIE (3) . . 177 . G22;
                                                                                        689456
      ACT . . . 434 . ANS !
                                                                                       669466
      ACT.,.389,AWS;
                                                                                       369476
G9
      GOON, 1;
                                                                                       599486
```

```
101/ATRIB(3)//257/020/
401//412/A/5/
401///238/4W8/
                                                                                       134523
                                                                                       2395.3
                                                                                       339512
A THUS NETWORK FOLLOWS THE ELECTRICAL SUBSISTEM, WILLOW 40,
                                                                                       309513
I IN THE BAME PATTERN AS ABOVE.
                                                                                       289543
                                                                                       837558
EV5 EVE/5/11
                                                                                       327563
      ACT., ATRIB(3), EQ. 2, 15;
                                                                                       339573
      ACT. (ATRIBIZ. .EG.1.018)
                                                                                       399588
      ACT: ATRIB(2).E3.2.G117
                                                                                       929593
GIR GOON, II
                                                                                       539663
      ACT, 4TRIB(3) .. 113, G22;
                                                                                       329613
      ACT . . . 278 . Ac. 1
                                                                                       337623
      ACT. . . 787 . AND 1
                                                                                       29639
      ACT. . . #51 / A#51
                                                                                       399548
      4CT.,.#51,489;
                                                                                       30965€
G11 GCGN+14
                                                                                       239662
      ACT+ATRIE-3)+.235+G22F
                                                                                       209678
      ACT++.576+AM31
                                                                                       839688
      ACT. . . 189 . A.S.
                                                                                       229698
                                                                                       899788
: THIS METHOR: LLOWS THE PNEUDRAULICS SUBSYSTEM: W.U.C. 45:
                                                                                       309710
: IN THE SAME PAITERN AS ABOVE.
                                                                                       209718
                                                                                       369736
                                                                                       699743
EV6 EVE,6,1;
                                                                                       069750
      ACT., ATRIB(3).EQ. 3.G61
      ACT . , ATRIB (2) . EQ. 1 . G12 i
                                                                                       969769
      ACT , , ATRIB (2) .EQ.2, G13;
                                                                                       669774
G12 GG0N+1;
                                                                                       209786
      ACT+ATRIB(3)+.#23+G22#
                                                                                       889798
      ACT++.912+AW4+
                                                                                       999999
      ACT.,.365,AW31
                                                                                       999819
G13 GGGN-19
                                                                                       889828
      ACT, ATRIB (3), . #82, G22;
                                                                                       009639
      ACT.,.728,AW4;
                                                                                       839848
                                                                                       897859
      ACT++,146+AW6;
      ACT.,. #52, ANS;
                                                                                       999869
                                                                                       999879
  THIS NETWORK FOLLOWS THE FUEL SUBSYSTEM, W.U.C. 46,
                                                                                       869886
  IN THE SAME PATTERN AS ABOVE.
                                                                                       469894
                                                                                       689966
                                                                                       889919
EV7 EVE,7,1;
                                                                                       009928
       ACT, , ATRIB(3) . EQ. #, Q7;
       ACT, , ATRIB(2) .EQ. 1, G14;
                                                                                       ##993#
      ACT., ATRIB(2) .EQ.2, G15;
                                                                                       889948
G14 G00N,1;
                                                                                       989958
      ACT:ATRIB(3):.868:G22;
                                                                                       889968
      ACT . . . 54# , AW7 ;
                                                                                       209970
                                                                                       669986
      ACT.,.392,AW8;
```

....

```
239493
0.E | 000No11
                                                                                     813833
      ACT/ATRIB(3),.097,622;
      ACT.,.416,4W31
                                                                                     312313
      ACT.,.209.AW7;
                                                                                     218623
      ACT., .278, AUS;
                                                                                    2:3232
                                                                                     213343
: THIS METWORK FOLLOWS THE INSTRUMENTS SUBSISTEMS, W.J.C. 51,
                                                                                     312053
                                                                                     310362
: IN THE SAME PATTERN AS ABOVE.
                                                                                     3:2973
                                                                                     312083
EV8 EVE.8.11
      ACT . ATRIB (3) .EQ. #. G8;
                                                                                     313998
                                                                                     213139
      ACT, (ATRIB(2).EG.1,G16;
      ACT, ATRIB(2).EQ.2,G17;
                                                                                     3:0:10
G16 GDGN-1;
                                                                                     313129
      ACT, ATRIE (3) . . 898, G22;
                                                                                     010130
      ACT,,,992,AWS;
                                                                                     318143
                                                                                     313153
G17 G00N+1;
      ACT+ATRIB(3)+.077+G221
                                                                                     #19169
      ACT.,.528,AW8;
                                                                                     818178
      ACT ... 277 . AW9;
                                                                                     313139
      ACT . . . 118 . AW131
                                                                                     616196
                                                                                     818298
THIS NETWORK FOLLOWS THE RADAR SUBSYSTEM, W.U.C. 72,
                                                                                     3132:2
; IN THE SAME PATTERN AS ABOVE.
                                                                                     813229
                                                                                     010230
                                                                                     6:3248
EV9 EVE,9,1;
      ACT . ATRIB (3) .EQ. # . Q9;
                                                                                     21925a
                                                                                     010260
      ACT - + 4TRIB (2) .EG. 1 - G18;
      ACT , ATRIB (2) .EG. 2, G19;
                                                                                     3:3273
                                                                                     010280
G18 G00N+1;
      ACT.ATRIB(3)..908.G22;
                                                                                     918299
                                                                                     412329
      ACT++.992+AH1#1
                                                                                     313318
G19 GGON+19
                                                                                     919329
      ACT, ATRIB(3), . $12, G22;
                                                                                     Ø19338
      ACT,,,588,AW13;
                                                                                     919349
      ACT ... 488 AU11;
                                                                                     010350
: THIS NETWORK FOLLOWS THE MALFUNCTION ANALYSIS SUBSYSTEM,
                                                                                     310369
; W.U.C. 55 IN THE C-5, OR THE INERTIAL NAVIGATION SUBSYSTEM,
                                                                                     216376
; W.U.C. 73 IN THE C-141, IN THE SAME PATTERN AS ABOVE.
                                                                                     91938
                                                                                     818398
                                                                                     314446
EV1# EVE,18,1;
       ACT, ATRIB(3) .EQ. 6,Q16;
                                                                                     618418
       ACT, , ATRIB (2) .EQ.1, G25;
                                                                                     818428
       ACT, ATRIB(2) .EQ.2,G21;
                                                                                     818438
                                                                                     616446
C26
      COON, 1;
                                                                                     616458
       ACT, ATRIB(3), . 662, G22;
                                                                                     $19468
       ACT . . . 567 . AN187
                                                                                     918478
       ACT . . . 431 , AW11;
                                                                                     919488
G21 COON-1;
```

40T/ATRIB(0)/.B42/G221	817498
907 <i>8</i> 86.,AW3;	91359 <i>2</i>
ACT:::872:AM111	313518
;	3:3523
;	Ø1J53 <b>3</b>
FITHE NEXT SERIES OF NETWORKS REPRESENT THE ALLOCATION OF THE	
MAINTENANCE SPECIALTIES THAT HAVE BEEN MODELED. AFTER THE	
MAINTENANCE HAS BEEN DONE AND SUPPLY DELAYS ACCOUNTED FOR.	
ALL OF THESE NETWORKS END AT G22. TFUS, AS ABOVE, ONLY THE	
FIRST WILL BE EXPLAINED IN DETAIL.	31 <b>3</b> 58 <b>3</b>
!	919598 919598
, ; THIS NETWORK FOLLOWS THE ASSIGNMENT OF AFSC 431R2, THE FLIG	
The second state of the se	
CONTROLS MAINTENANCE PERSONNEL. THE SUBSYSTEMS WAIT HERE FO	
PERSONNEL TO BE ASSIGNED	919629
•	810638
AW1 AWA(11) M431R2/1,1;	919649
MAINTENANCE IS ACCOMPLISHED FOR THE TIME IN ATTRIBUTE 3.	. 319859
MAINTENANCE IS ACCOMPLISHED FOR THE TIME IN ATTRIBUTE 3.	Ø1366Ø
	31 <b>267</b> \$
ACT:ATRIB(3);	919689
<b>;</b>	913699
FITHE MAINTENANCE PERSONNEL ARE FREED.	81 <b>0780</b>
;	010710
FRE+M431R2/1+1;	818728
• •	8:8738
; IF THERE IS NO SUPPLY DELAY IN ATTRIBUTE 4, THE SUBSYSTEM	919749
FROCEEDS TO G22.	919759
	319769
ACT,,ATRIB(4).EQ.Ø,G22;	9:8778
**************************************	9:0760
; IF THERE IS A SUPPLY BELAY, WE WAIT FOR SPARE PARTS FOR THE	
AMOUNT OF TIME IN ATTRIBUTE 4, AND THEN SET ATTRIBUTE 4 EQUA	9.8/79 2.4/4
TO ZERO SO THE SUBSYSTEM WILL NOT INCUR ANY FURTHER DELAY.	L 919899
ACT ATDIDIES ATDIDIES OF 35	313823
ACT, ATRIB(4), ATRIB(4).GT.#;	<b>818838</b>
ASS/ATRIB(4)=#;	919849
j	818858
FROM HERE, THE SUBSYSTEM IS ROUTED BACK TO THE AWAIT NODE	919869
TO HAVE MAINTENANCE MEN RE-ASSIGNED SO THE REPAIR CAN BE	<b>919879</b>
COMPLETED WITH THE SPARE PARTS. NOTE THAT THE REPAIR TIME	<b>91988</b>
WAS ACTUALLY CUT IN HALF, IN THE EVENT ROUTINE, TO MAKE	<b>010896</b>
THIS DOUBLE TRIP THROUGH MAINTENANCE POSSIBLE. AFTER THE	818988
HAINTENANCE IS COMPLETE, SUPPLY DELAY IS ZERO, SO THE	616916
SUBSYSTEM WILL GO TO G22.	618928
i e	\$18938
ACT+++AW1;	818948
}	818958
THIS NETWORK FOLLOWS THE ASSIGNMENT OF AFSC 431W2, THE LANDI	
GEAR MAINTENANCE PERSONNEL, IN THE SAME PATTERN AS ABOVE.	616976
The second secon	018986
·	

```
31,3953
942 AVA(12) //48192/1/17
                                                                                 011000
      ACT (ATRIBABIL)
      FRE(#431#2/1)11
                                                                                 311213
      ACT + ATRIE (4) .Eq. 0 + G22;
                                                                                 311333
      ACT:ATRIB(4):ATRIB(4).GT.8F
                                                                                 311349
     ASSIATRIE(4)=8;
                                                                                 811258
     ACT: .. AW2;
                                                                                 311868
FITTE NETWORK FOLLOWS THE ASSIGNMENT OF AFSC 423X0, THE
                                                                                 011679
                                                                                 3::383
; ELECTRICAL SYSTEMS MAINTENANCE PERSONNEL, IN THE SAME PATTERN
                                                                                 21:398
I AS ABOVE.
                                                                                 011120
                                                                                 811118
AW3 AWA(13):M423X0/1:17
      ACT, ATRIB(3);
      FRE+#423X8/1+17
      ACT,,ATRIB(4).EQ.8,G22;
                                                                                 811149
                                                                                 311159
      ACT, ATRIB(4), ATRIB(4).GT.6;
                                                                                 8::160
      ASS.ATRIB(4)=0;
                                                                                 611176
      ACT: , AW3;
                                                                                 311133
: THIS NETWORK FOLLOWS THE ASSIGNMENT OF AFSC 423X4, THE
                                                                                 311199
; PNEUDRAULICS MAINTENANCE PERSONNEL, IN THE SAME PATTERN
; AS ABOVE.
                                                                                 311220
AW4 AWA(14) ##423X4/1+19
                                                                                 811248
      ACT:ATRIB(3);
      FRE+M423X4/1+1;
                                                                                 911253
                                                                                 811263
      ACT:,ATRIB(4).Eq.#,G22;
      ACT, ATRIB (4), ATRIB (4).GT.07
      ASS, ATRIB(4) =#;
      ACT, , AW4;
                                                                                 911336
: THIS NETWORK FOLLOWS THE ASSIGNMENT OF AFSC 426X2. THE ENGINE
; MAINTENANCE PERSONNEL, IN THE SAME PATTERN AS ABOVE.
                                                                                 211329
                                                                                 811238
                                                                                 Ø11349
AWS AWA (15) + 426 X2/1,1;
                                                                                 #1135#
      ACT, ATRIB(3);
                                                                                 611369
      FRE+M426X2/1-1;
                                                                                 611376
      ACT,,ATRIB(4).EQ.8,G22;
                                                                                  011386
      ACT, ATRIB(4), ATRIB(4).GT.#;
       ASS, ATRIB(4) =#;
                                                                                  911379
      ACT,,,ANS;
                                                                                  611416
; THIS NETWORK FOLLOWS THE ASSIGNMENT OF AFSC 423X1, THE
                                                                                  811428
; ENVIRONMENTAL SYSTEMS MAINTENANCE PERSONNEL, IN THE
                                                                                  #11436
                                                                                 611446
; SAME PATTERN AS ABOVE.
                                                                                 611456
                                                                                 $1146B
     AWA(16),M423X1/1,1;
                                                                                 911476
       ACT ATRIB(3);
                                                                                  611486
       FRE, M423X1/1,1;
```

```
ACT+,ATRIB(4).EQ.0,G221
                                                                                  31149
      ACT, ATRIB(4), ATRIB(4).GT.8;
                                                                                  311500
      ASS,ATRIB(4)=#;
                                                                                  311513
      ACT. . . AW61
                                                                                  3:1523
                                                                                  311533
1 THIS NETWORK FOLLOWS THE ASSIGNMENT OF AFSC 420X3, THE FUEL
                                                                                  811548
; SYSTEMS MAINTENANCE PERSONNEL, IN THE SAME FATTERN AS ABOVE.
                                                                                 Ø1155Ø
                                                                                 01.568
AW7 AWA (17) - M423X3/1-11
                                                                                 311573
      ACT:ATRIB(3);
                                                                                  811588
      FRE: M423X3/1:11
                                                                                  311590
      ACT, ATRIB (4) .EQ. 3, G22;
                                                                                  311133
      ACT:ATRIB(4):ATRIB(4).GT.#;
                                                                                  311513
      ASS, ATRIB(4) = 01
                                                                                  011520
      ACT+++AW7;
                                                                                  011630
                                                                                  311649
; THIS NETWORK FOLLOWS THE ASSIGNMENT OF AFSC 325X1, THE AVIONIC
                                                                                  011659
; INSTRUMENTS MAINTENANCE PERSONNEL, IN THE PATTERN AS ABOVE.
                                                                                  911669
                                                                                  911679
AWS AWA(18) - M325X1/1-17
                                                                                  011882
      ACT:ATRIB(3);
                                                                                  2:1690
      FRE,#325X1/1,1;
                                                                                  611739
      ACT, ATRIB(4) .EG.Ø.G22;
                                                                                  811718
      ACT, ATRIB (4), ATRIB (4).GT.8;
                                                                                  011720
      ASS, ATRIB(4)=#;
                                                                                  911739
      ACT, , , Ad8;
                                                                                  911746
                                                                                  311753
; THIS NETWORK FOLLOWS THE ASSIGNMENT OF AFSC 325X2, THE
                                                                                  311769
# AUTOMATIC FLIGHT CONTROLS MAINTENANCE PERSONNEL, IN THE
                                                                                  211779
: SAME PATTERN AS ABOVE.
                                                                                  811738
                                                                                  31:799
AW9 AWA(19) #M325X3/1,1;
                                                                                  311899
      ACT, ATRIB(3);
                                                                                  Ø1131Ø
      FRE, #325 X8/1,1;
                                                                                  811829
      ACT, ATRIB(4) .EQ.#,G22;
                                                                                  #1183#
      ACT:ATRIB(4):ATRIB(4).GT.#;
                                                                                  311949
      ASS ATRIB(4)=6;
                                                                                  811858
      ACT.,,AM9;
                                                                                  611866
                                                                                  911879
THIS NETWORK FOLLOWS THE ASSIGNMENT OF AFSC 328X1, THE AVIONIC
                                                                                  Ø1188Ø
; NAVIICATION SYSTEMS MAINTENANCE PERSONNEL, IN THE SAME PATTERN
                                                                                  311896
; AS ABOVE.
                                                                                  $11995
                                                                                  #1191#
AU16 AUA (26) - M328X1/1-1;
                                                                                  $11925
      ACT ATRIB(3);
                                                                                  $11939
      FRE, M328X1/1 1;
                                                                                  811945
      ACT. ATRIB(4) .EQ. Ø. G22;
                                                                                  811958
      ACT, ATRIB(4), ATRIB(4).GT.#;
                                                                                 611968
      ASS ATRIB(4) =#;
                                                                                  $11975
                                                                                  $119E$
      ACT,,,AU18;
```

```
311999
   THIS METHORN FOLLOWS THE ASSIGNMENT OF AFSC 328X4, THE INERTIAL
  AND RADAR MAVIGATION SYSTEMS MAINTENAMOS PERSONNEL, IN THE SAME
                                                                                 312318
: PATTERN AS ABOVE.
AW11 AWA(21) #8328X4/1,11
                                                                                 912949
      ACT - ATRIB (3) }
                                                                                 312350
      FRE/MS28X4/1,1;
                                                                                 Ø12363
      ACT++ATRIE(4).E9.2+G221
                                                                                 312376
      ACT.ATRIB(4).ATRIB(4).GT.ØF
                                                                                 Ø12Ø8Ø
      ASS.ATRIB(4):0;
                                                                                 912090
      ACT,,,AW11;
                                                                                 912:29
                                                                                 0:2110
; NOTE THAT ALL SUBSYSTEMS CONVERGE ON THIS POINT, FROM THE
: NETWORKS THAT MODEL MAINTENANCE PERSONNEL, OR DIRECTLY
                                                                                 Ø1213Ø
; FROM THE BRANCHING NODES AFTER THE EVENTS.
                                                                                 812149
                                                                                 812158
G22 G00N.1:
                                                                                 012160
                                                                                 0:2170
: IF THE SUBSYSTEMS THAT CAME FROM THE BRANCHING NODES STILL
                                                                                 912199
I HAVE SUPPLY BELAY TIME IN ATTRIBUTE 4, THAT TIME PLUS THE
                                                                                 812198
; SECOND TIME THROUGH THE MAINTENANCE TIME ARE ACCOUNTED FOR
                                                                                 8:2228
F ON THE WAY TO G23.
                                                                                 312218
                                                                                 912228
     ACT, ATRIB(3) +ATRIB(4), ATRIB(4).GT.Ø,G23;
                                                                                 012230
                                                                                 812248
  ALL OTHERS, WITH ATTRIBUTE 4 EQUAL TO ZERO, PROCEED TO G23
                                                                                 012250
  WITH NO CELAY.
                                                                                 Ø1226#
                                                                                 8:2279
     ACT,,ATRIB(4).EQ.#,G23;
                                                                                 012290
; FROM THIS NODE, THE SUBSYSTEMS GO TO THE APPROPRIATE QUELE.
                                                                                 #1233#
F ATTRIBUTE 5 IS SET, IN EACH EVENT, TO THE NUMBER OF THAT
: EVENT. THUS, THE CONDITIONAL BRANCHING ENSURES THAT EACH
                                                                                 012320
  SUBSYSTEM WILL WAIT IN THE APPROPRIATE QUEUE.
                                                                                 #1233#
                                                                                 912349
G23 G00N:1;
                                                                                 312359
     ACT .. ATRIB(5) .EQ.1.Q1;
                                                                                 #1236#
      ACT, ATRIB(5) .EQ.2,92;
                                                                                 312379
      ACT .. ATRIB(5) .EQ.3.Q3;
                                                                                 Ø1238Ø
      ACT, ATRIB(5) .EQ.4,Q4;
                                                                                 Ø1239Ø
      ACT, , ATRIB (5) .EQ.5,Q5;
      ACT , ATRIB (5) . EQ. 6, Q6;
                                                                                 #1241#
      ACT,,ATRIB(5).EQ.7,Q7;
                                                                                 812428
     ACT , ATRIB(5) .EQ.8,98;
                                                                                 Ø12438
     ACT,,ATRIB(5).EQ.9,Q9;
                                                                                 612446
     ACT .. ATRIB(5) .EQ. 16.016;
                                                                                 #1245#
                                                                                 812468
; THESE TEN JUEUES CORRESPOND TO THE SAME NUMBER EVENTS.
                                                                                 612476
; SO EACH SUBSYSTEM HAS A DISTINCT PLACE TO WAIT FOR
                                                                                 #1248#
```

- washing to

```
1 COMPLETION OF MAINTENANCE IN ALL TEN SUBBYSTEMS.
      SUE/SET HATCH
     QUE (23) ... MATC:
     QUE (24) ... MATC!
33
                                                                           8:1538
     GUE (25) ****MATO;
                                                                           312548
35
    QUE (25) .... MATC!
                                                                           812558
    GUE (27) **** MATC!
                                                                           8:2548
    GUE(28),,,,MATC;
                                                                           312573
GS GUE (29) , , , MATC;
                                                                           2:2582
99 QUE(30) ....MATC;
                                                                           #1259#
918 QUE(31) *** MATO;
                                                                           312688
F WHEN ALL TEN SUBSYSTEMS HAVE COMPLETED MAINTENANCE, SHOWN BY
: HAVING AN ENTITY IN EACH OF THE TEN SUBLES WITH THE SAME MARK
   TIME IN ATTRIBUTE 1, THEY ARE MATCHED AND SENT TO A1.
                                                                           312553
MATC MAT/1/81/A1/82/A1/83/A1/84/A1/95/A1/96/A1/97/A1/88/A1/89/A1/
     213/A17
                                                                           8:2579
! THE ACCUMULATE NODE COMBINES ALL TEN SUBSYSTEMS INTO ONE
                                                                           912499
  AIRCRAFT THAT IS READY TO BEPART MAINTENANCE.
                                                                           9:2788
 A1 ACCUM, 18, 18, HIGH (3), 1;
                                                                           812726
;<del>**********************************</del>
                                                                           312748
.
                                                                           #12753
, #
        AT THIS POINT, THE AIRCRAFT DEPARTS MAINTENANCE
                                                                           812763
                                                                          612779
212732
                                                                           2127°3
                                                                           312800
FAIRCRAFT TURNAROUND AND RETURN TO ACFT RESOURCE WHERE IT
                                                                          812818
WAITS FOR CARGO (SEE BEGINNING OF NETWORK).
                                                                          812818
                                                                          912539
     ACT: USERF(4): ATRIB(2).EQ.1:F:41;
                                                                          812348
     ACT, USERF (5) ATRIB (2) .EQ. 2, FC5;
                                                                          912859
                                                                          312869
SONCE THE ACFT IS FIXED, IT IS MADE AVAILABLE FOR USE.
                                                                          312879
                                                                          8:2888
F141 FRE, C141/1;
                                                                           812898
      TERM;
                                                                           812988
FC5 FRE, C5/1;
                                                                           612916
      TERM;
                                                                           #1292#
     END;
                                                                          612936
INIT.4.726:
                                                                          #1294#
SEEDS: -124397822916957(1): -3467133363389(2): -79654468614381(3);
                                                                          212954
SEEDS,-18417#232136813(4),-28##33#29935#85(5),-147959512963949(6);
                                                                          612966
SEEDS,-125894583854829(7);-156477775663725(8);-227874746727917(9);
                                                                          812978
SEEDS,-82174077946221(16);
                                                                          #1298#
MONTR.SUMRY.24.,24.;
                                                                          #12999
FINE
                                                                           613869
```

## VITA

Wayne P. Stanberry was born 16 October 1948 in Roswell, New Mexico. He graduated from high school in Murfreesboro, Tennessee in 1966 and enlisted in the United States Air Force. He attended the United States Air Force Academy Preparatory School in 1968 and the United States Air Force Academy, from which he received a Bachelor of Science degree in June 1973. After completing pilot training at Williams AFB, he spent four years as a C-141 pilot at Charleston AFB, South Carolina. In 1978, he transferred to Shepherd AFB, Texas and taught German and Dutch students as a flying training instructor. After completing Squadron Officers School at Maxwell AFB, he entered the School of Engineering, Air Force Institute of Technology, in August 1980.

SECURITY CLASSIFICATION OF THIS PAGE (When Dete Entered)

REPORT DOCUMENTATI	ON PAGE	READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVE ACCESSION NO	
AFIT/GST/OS/82M-13	ווט אין פ	119
I. TITLE (and Subtitle) AND TREPOSTED MATERIALISE MOR		5. TYPE OF REPORT & PERIOD COVERED
AN IMPROVED MAINTENANCE MOD SIMULATION OF STRATEGIC AIF	OEL FOR THE	MS Thesis
CIMODATION OF STRATEGIC AL	TITLE CAPABILITY	6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(a)		8. CONTRACT OR GRANT NUMBER(8)
Wayne P. Stanberry		
Captain, USAF		
9. PERFORMING ORGANIZATION NAME AND ADD	RESS	10. PROGRAM ELEMENT, PROJECT, TASK
Air Force Institute of Tech		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
Wright-Patterson AFB, Ohio	45433	
,	.5 .55	
1. CONTROLLING OFFICE NAME AND ADDRESS	<del></del>	12. REPORT DATE
		March 1982
		13. NUMBER OF PAGES
4. MONITORING AGENCY NAME & ADDRESS(If dit	(ferent from Controlling Office)	15. SECURITY CLASS. (of this report)
		UNGLAGORILD
		154 DECLASSIFICATION/DOWNGRADING
Approved for public release	tered in Block 20, if different tra	
LYNN E. WOLAVER T.	tered in Block 20, if different from	m Report)
7. DISTRIBUTION STATEMENT (of the ebetrect ent	tered in Block 20, if different from	m Report)
LYNN E. WOLAVED T.	tered in Block 20, if different from	m Report)
LYNN E. WOLAVER WOLAVER Professional Development	tered in Block 20, if different tra	e; IAW AFR 190-17
LYNN E. WOLAVER DEPOYER OF Professional Development  R FORCE INSTITUTE OF TECHNOLOGY	or public releas	e; IAW AFR 190-17
LYNN E. WOLAVER DEPOSE OF THE PROPERTY OF THE	or public releas	e; IAW AFR 190-17  h. Major USAF 4 JUN
LYNN E. WOLAVER WOLAVER Professional Development  R FORCE INSTITUTE OF TECHNOLOGY  RIGHT-PATTERSON AFB, OH 45433  S. KEY WORDS (Continue on reverse side if necessary)	or public releas	e; IAW AFR 190-17  h. Major USAF 4 JUN
LYNN E. WOLAVER  Professional Development  R FORCE INSTITUTE OF TECHNOLOGY  RIGHT-PATTERSON AFB, OH 45433  KEY WORDS (Continue on reverse side if necessariants)  Strategic Airlift	or public releas	e; IAW AFR 190-17  h. Major USAF 4 JUN
LYNN E. WOLAVER Professional Development  R FORCE INSTITUTE OF TECHNOLOGY RIGHT-PATTERSON AFB, OH 45433  KEY WORDS (Castinus on reverse side if necessaristic desired and the side of the state of the s	or public releas	e; IAW AFR 190-17  h. Major USAF 4 JUN
LYNN E. WOLAVER  Professional Development  R FORCE INSTITUTE OF TECHNOLOGY  RIGHT-PATTERSON AFB, OH 45433  KEY WORDS (Continue on reverse side if necessariant and the side of	or public releas	e; IAW AFR 190-17  h. Major USAF 4 JUN
LYNN E. WOLAVER Professional Development  R FORCE INSTITUTE OF TECHNOLOGY RIGHT-PATTERSON AFB, OH 45433 Exer words (Continue on reverse side if necessariant and the side of the second and t	or public releas  Y (ATC) F.O. Lyne Director	e; IAW AFR 190-17  h. Major USAF 4 JUN
LYNN E. WOLAVER  Professional Development  IR FORCE INSTITUTE OF TECHNOLOGY  PRICHT-PATTERSON AFB, OH 45433  EXEL WORDS (Continue on reverse side if necessariant and the state of the stat	for public releas  SY (ATC) F.O. Lyne Director  my and identify by block number)	e; IAW AFR 190-17  h. Major HSAF  Of Information
LYNN E. WOLAVER  Professional Development  IR FORCE INSTITUTE OF TECHNOLOGY  PROFITE AIR TOTAL OF TECHNOLOGY  PROFITE AIR TOTAL OF TECHNOLOGY  RIGHT-PATTERSON AFB, OH 45433  EXEX WORDS (Continue on reverse side if necesses  Strategic Airlift  Simulation Model  Maintenance Manning  Airlift Capability  SLAM  O. ABSTRACT (Continue on reverse side if necesses  The subject of this	For public release (ATC) F.O. Lync Director (ATC) From Lync Director (ATC) and identify by block number) thesis is model	e; IAW AFR 190-17  h. Major USAF Of The maintenance
LYNN E. WOLAVER  Professional Development  IR FORCE INSTITUTE OF TECHNOLOGY  PRICHT-PATTERSON AFB, OH 45433  Extrategic Airlift  Simulation Model  Maintenance Manning  Airlift Capability  SLAM  O. ABSTRACT (Continue on reverse side if necessar  The subject of this  function in the strategic a.	for public release of (ATC) F.G. Lyne Director or and identify by block number) thesis is model irlift system.	e; IAW AFR 190-17  h. Major USAF  Of Information  ing of the maintenance The implicit assump-
LYNN E. WOLAVER  Professional Development  R FORCE INSTITUTE OF TECHNOLOGY  RIGHT-PATTERSON AFB, OH 45433  KEY WORDS (Continue on reverse side if necessariant and the strategic and the subject of this function in the strategic actions of the universal main:	Tor public release of ATC) F.O. Lyne Director or and identify by block number; thesis is model irlift system.	e; IAW AFR 190-17  h. Major USAF  Of Information  ing of the maintenance The implicit assump- ept are investigated
LYNN E. WOLAVER  Professional Development  R FORCE INSTITUTE OF TECHNOLOGY  RIGHT-PATTERSON AFB, OH 45433  Extrategic Airlift  Simulation Model  Maintenance Manning  Airlift Capability  SLAM  ABSTRACT (Continue on reverse side if necessar  The subject of this  function in the strategic actions of the universal maintenance of the universal maintenance of the subject of this  Consolidation is developed using	Tor public release of ATC) F.C. Lyne Director of and identify by block number; thesis is model irlift system. tenance man concedetailed model of SLAM as the prince	e; IAW AFR 190-17  h. Major USAF  of Information  ing of the maintenance The implicit assump- ept are investigated f the maintenance mary simulation lan-
LYNN E. WOLAVER  Professional Development  IR FORCE INSTITUTE OF TECHNOLOGY  PROFITE AIR TOTAL OF TECHNOLOGY  PROFITE AIR TOTAL OF TECHNOLOGY  RIGHT-PATTERSON AFB, OH 45433  EXEX WORDS (Continue on reverse side if necesses  Strategic Airlift  Simulation Model  Maintenance Manning  Airlift Capability  SLAM  O. ABSTRACT (Continue on reverse side if necesses  The subject of this	or public releas  Y (ATC) F.C. Lync Director  To and identify by block number)  thesis is model: irlift system. tenance man concederailed model of SLAM as the print is modeled at the concederation of the concederation o	e; IAW AFR 190-17  h. Major USAF  of Information  ing of the maintenance The implicit assump- ept are investigated f the maintenance mary simulation lan- he Air Force Specialty

DD 1 JAN 73 1473 EDITION OF 1 NOV 68 IS OBSOLETE

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Date Entered)

1982

SECURITY CLASSIFICATION OF THIS PAGE(When Date Entered)

requirements. Maintenance discrepancies are determined for major subsystems of the airlift aircraft, and distributions for repair times are estimated for each subsystem. Substituting the detailed model of maintenance for a model that uses universal maintenance men, subsequent runs of a simulation of the airlift system show the assumptions of the universal maintenance man concept to be invalid. Additionally, in a simulation using aggregate bases, maintenance manning is not a significant factor.

UNCLASSIFIED